THE AMERICAN GAS LIGHT JOURNAL

PUBLISHING OFFICE No. 32 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXXIII.—No. 19. Whole No. 1,326. | NEW YORK, MONDAY, NOVEMBER 5, 1900. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager. THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 32 Pine Street, New York.

Collections are invariably made directly from this office for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $5 (£1—25 francs). All payments to be made in advance. Single copies, 10 cents.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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BRIEFLY TOLD.

THE PROCEEDINGS OF THE DENVER MEETING OF THE AMERICAN GAS LIGHT ASSOCIATION.—With this issue of the JOURNAL we commence our "Limited Abstract" of the proceedings of the recent meeting of the American Gas Light Association, held at Denver last month, under the presidential direction of Mr. George G. Ramsdell. We regret very much that our account of the technical work of the meeting is quite disjointed, but the responsibility for this must be put upon the Association. The technical work was concluded in Denver, the afternoon of October 18th, and Secretary Forstall did not return to New York until October 27th, nor was he able to furnish any part of the routine records of the meeting until the following Monday. We know that he is quite a busy man, and it is really unfortunate that he did not have more assistance at Denver. Almost any ordinary local clerical worker could be depended upon to forward, either through the mails or by express, the stenographic report of the meeting, corrected for the purpose of "abstracting," especially as those who attended the meeting had been informed, through the official notices, that "If any of the speakers at this meeting desire to correct their remarks before they are printed they will be given an opportunity before leaving Denver, Col., but not after." However, the Council of the Association and Secretary Forstall are responsible for the "early" appearance of the Association's "Year Book," and their laudable desire on the book's behalf is the cause of our failure to give connectedly the report of the proceedings, even in the shape of a limited abstract. Out of the fragments at hand we are enabled this week to give the text of the paper, by Mr. A. H. Barret, Chief Engineer of the Louisville (Ky.) Gas Company, respecting the plan followed in the construction of his Company's new retort house, equipped on the inclined principle. It is unfortunate that we are not able to publish the drawings with the text, but it is our intention to put them before our readers later, in the shape of a special supplement. Luckily, however, the text is readily understandable without the drawings. The paper itself is quite like that which one might expect from an engineer of Mr. Barret's training. It is matter-of-fact, clear and concise, and not even a trifle prosaic. And it is positive proof that, while other students of the inclined retort principle in America were doing much thinking, the Louisville Company and Mr. Barret were up and doing. It is a pity that the time between the putting in actual work of the Louisville retort house, and the period of the meeting was not greater, for in that event we would have had actual figures of make, coke production and use, tar and the like, with positive knowledge as to cost on the side per 1,000 of the labor account. However, Mr. Barret's paper certainly goes to show that he is well satisfied so far with the results obtained, and he is not the sort of man in any sense to attempt to fool himself, even though he should experience the enthusiastic thrill that comes to the one who is a leader in the gas practice of his own country in any particular way; for it may not be truthfully denied that his Company was the first in America to depend altogether on inclined retorts in its generating division, and that he was the man who advised the revolution. In the course of three months we will have actual figures of his working results, and at or about the same time we shall have other figures detailing the working of the second installation of inclined retorts in America,

planned for the Kings County Gas and Illuminating Company of Brooklyn, N. Y., by Mr. Fred. Mayer, of Bartlett, Hayward & Company, at the instigation or direction of the Kings County Company's Chief Engineer, Mr. Thomas E. Byrne. Mr. Barret, in closing his interesting paper pays a very clever tribute to "One of our members who has so persistently and courageously kept the slopers before our attention in the face of most trying and adverse conditions." Why Mr. Barret did not personally name the member is his own reason, but we have no hesitation in saying that the member referred to is Mr. Frederic Egner.

DR. LOVE'S LECTURE.—In our current issue we give the text of the lecture, delivered by Dr. E. G. Love at the Denver meeting, the subject of his discourse being "The Theory of the Incandescent Gas Light." Perhaps what was thought of his presentation of the subject may be well known by the printing of the following lines from a correspondent regarding it—and our correspondent's views thereon we heartily endorse: "The pleasure that came to all those who heard Dr. Love's lecture before the Association at Denver will come in some measure to those who will later on read it in the JOURNAL. I say your readers will enjoy it in some measure only for the reason that, in the form of type it will have lost that personality which for the moment made the mantle animate. It would have been a still greater pleasure to those who heard it and an additional profit to all who will read it had the lecture been a trifle longer. The Doctor might have added much to what he said, drawing on the riches of his personal experience, as well as on that material accessible to all students, without in the least incurring risk of an unkind criticism. When Dr. Love gives us the fruit of his studying we appreciate his labor in separating the kernel from the husk and giving us kernel only, and that kernel stamped with his approval. Having been impressed with the work of Doctor Bunte and of Doctor Killing, one may not fail to feel that Doctor Love puts their findings as the law and gospel of the subject. Yet one would have been glad to have heard the results of his personal work, to know how Bunte agreed with Love and Love with Bunte. It would have been, to a delver such as I know myself to be, a rare privilege to have been with Dr. Love in his 'alchemical den' and shared with him the pleasure of checking up the work, to have been a partner in the conversation, and to have known the details of the experiments that were disappointments here and agreements there. It may be he will tell us something of this later on—the detail of the growth, the development of his opinion—when time shall afford the opportunity. However, he gave us at Denver a royal treat. Selfish it may be; but we ask for more. And the writer sincerely hopes that the thought will come true. —R."

NOTES.—The Board of Gas and Electric Light Commissioners have issued the authorization necessary to enable the Municipal Gas Works of Wakefield, Mass., to supply gas to the adjoining town of Stoneham. ——The net earnings of the Milwaukee Gas Light Company for the 9 months ended Sept 30, 1900, as compared with the corresponding period of 1899, show a gain of 8.43 per cent.——The L. M. Rumsey estate, on the 30th ult., sold to Mr. J. Frank Andus, of Alton, Ills., the plant and franchises of the Lexington (Mo.) Gas Light Company. The purchase price was $26,000. Mr. Andus took charge at Lexington, Thursday last.

The Preservative Virtue of Creosote.

The *Journal of Gas Lighting* notes that Mr. Hall has reported, in the "Analyst," on some instructive and simple experiments designed to test the preservative action of creosote and coal tar, and to ascertain to what constituents of the compounds this virtue is due. Lengths of good hemp string of known breaking stress were soaked in various extracts from creosote, and other pure materials, at water bath temperature. The string was then partly buried for two months in garden mould, dug up, and its strength redetermined. The results obtained gave a low value to the phenoloid constituents, and not much more to the naphthaline; but the less volatile fractions of the creosote, the basic constituents, and bone oil which is rich in similar bases, all preserved the string fairly well. Small deal rods, 8 inches long by ¾-inch square, were also soaked in the various tar oils for 1½ hours, at a temperature of 90° C., then buried to about three-quarters of their length in garden soil, taken up after about 10 months, washed, slowly dried, and the transverse breaking strength measured. The results showed that the creosote itself, and especially the less volatile fractions, had considerable preservative power; the phenoloid and basic constituents had a real but smaller preservative power; but pure cresol had little or none.

The general indication seems to he that the preservative action of coal tar creosote lies in its property of filling the cells of the wood with a fixed moisture resisting substance, rather than in any chemical antiseptic action. It is regarded as desirable, in the commercial valuation of creosote, to estimate the pyridine "tar bases," and to rate them as of equal preservative value to the "tar acids." This explanation of the nature of the preservative action of creosote on wood is not altogether a surprise.

[LIMITED ABSTRACT.]

TWENTY-EIGHTH ANNUAL MEETING, AMERICAN GAS LIGHT ASSOCIATION.

HELD AT BROWN PALACE HOTEL, DENVER, COL., COMMENCING, OCT. 17TH, 1900.

FIRST DAY, OCTOBER 17, 1900.

The Association was called to order the morning of October 17th by the President, Mr. Geo. G. Ramsdell, of Philadelphia, Pa. The Secretary occupied his proper place. On motion, the reading of the minutes of the last meeting was foregone.

APPLICATIONS FOR MEMBERSHIP.

The President called for the report of the Council, in respect of the applications for membership. The report submitted showed that the Council recommended the election of the following:

Active Members.

Baehr, Wm. A., Denver, Col.	Mann, H. E., Cleveland, O.
Bayley, C. C., Alexandria, Va.	Marks, W. D., Fostoria, O.
Bell, E. W., St. Louis, Mo.	Maynard, H. B., Ottumwa, Ia.
Blinks, W. M., Michigan City, Ind.	Miller, I. B., Colorado Springs, Col.
Burrows, C.E., Walla Walla, Wash.	Poole, J. H., Denver, Col.
Bush, J. F., Watkins, N. Y.	Purcell, T. V., New York City.
Calhoun, R., Bay City, Mich.	Robison, C. P., Geneva, N. Y.
Collins, H. P., Little Falls, N. Y.	Schwarn, Lorain, O.
Davies, H. W., Sag Harbor, L. I.	Simpson, M., Newark, N. J.
Dawes, R. C., Evanston, Ills.	Smart, F. R., Jr., York, Pa.
Dutton, R. H., West Chester, Pa.	Strong, C. D., Long Branch, N. J.
Frueauff, F. W., Denver, Col.	Tait, F. M., Somerville, N. J.
Hersh, P., York, Pa.	Thompson, P., Philadelphia, Pa.
Highlands, S. M., Clinton, Ia.	Travis, F. M., Torrington, Conn.
Hiramatsu, S., Tokyo, Japan.	Walker, M. T., Rockville, Conn.
Hunt, A. G. B, New London, Conn.	Walters, B. S., Darby, Pa.
Jourdan, C. R., New York City.	Wharton, W. S., New Whatcom, Wash.
Kennedy, J. S., New York City.	
McKenzie, W. H., Sioux Falls, S. D.	

Associate.

Bower, W. H., Phila, Pa.	Mueller, Rob't, Decatur, Ills.
Casey, W. J., San Francisco, Cal.	Payne, F. H., Erie, Pa.
Dickey, E. S., Baltimore, Md.	Tolman, W. N., Philadelphia, Pa.
Harper, H. D., Chicago, Ills.	Weber, Wesley, New York City.
Johnston, E. D., Connersville, Ind.	Windfelder, J. H., Baltimore, Md.
Latta, M. N., Charlotte, N. C.	Wood, E. R., Jr., Philadelphia, Pa.

From Associate to Active.

Wood, S., Philadelphia, Pa.

ELECTION OF NEW MEMBERS.

On motion of Mr. A. C. Humphreys the President directed the Secretary (Messrs. Humphreys and W. R. Beale acting as tellers) to cast the ballot of the Association in favor of the election as prescribed by the Council.

The President introduced those of the newly elected members that were present, welcoming them cordially to take positive part in the meeting.

REPORT OF THE COUNCIL IN OTHER RESPECTS.

The balance of the report of the Council (which was read by the Secretary) follows:

DENVER, COL., Oct. 17, 1900.

To the American Gas Light Association:—Gentlemen—Your Council has the honor to make its annual report as follows:

A separate report upon applications for membership recommends the election of 48 applicants.

We recommend for election to Honorary Membership, M. Th. Vautier, Pres. International Gas Congress, and also President of the Societe Technique de l'Industrie du Gaz en France, whose services even before his connection with the International Congress fully entitled him to this honor.

The resignations of 11 active and 2 associate members have been received and accepted during the year.

The following list of papers has been approved, to be read at this meeting:

"The Use of Cards for Records and Accounts," by Mr. W. C. Anderson, Norristown, Pa.

"Governmental Control of the Price of Gas," by Mr. A. E. Forstall, Montclair, N. J.

"Inclined Retorts," by Mr. A. H. Barret, Louisville, Ky.

Also, the following "Short Topics:"

"Gas Advertising;" "Removal of Tar from Water Gas;" "A Blue Glass Pyrometer;" "The Repair of a Broken 30-Inch Outlet Pipe from a Gasholder."

The Council reports that Dr. E. G. Love, of New York city, will deliver a lecture on "The Theory of the Incandescent Gas Light."

SUPPLEMENTARY REPORT OF COUNCIL.

DENVER, COL., Oct. 17, 1900.

To the American Gas Light Association: Gentlemen—Your Council recommends for election to Honorary Membership, Dr. Carl Auer von Welsbach, who, by his research, made possible the great development of gas lighting by incandescence, with which we are all familiar.

REPORT OF SECRETARY AND TREASURER.

The report of the Treasurer for the year showed a receipt, from dues and "various sources of income," of $3,278.95, plus a balance from the prior year of $452.18. The expenditures, also various, were $2,872.42. The balance of all ($859.11) is drawing interest. The report was certified to by the finance committee—Messrs. E. G. Pratt and Alten S. Miller.

Next came the

REPORT OF THE COMMITTEE ON RESEARCH,

which follows:

Gentlemen: Your Committee during the past year has undertaken experiments to determine a useful working standard for the measure of the illuminating power of gas, and a report of this work is contained in the appendix.

The indications are that, with proper treatment, the Harcourt 10 candle power standard and the Edgerton chimney, with the Sugg D Argand, are both highly satisfactory.

A member of the Committee offers some suggestions as to the lines to be followed in efforts to determine the proper point to mix coal and water gas. It is earnestly hoped that some of the members will experiment on this subject during the coming year and give us a report of the work at the next meeting of the Association.

In addition to the original research work described above, the Committee has secured the following contributions in the shape of short topics, namely:

"A Blue Glass Pyrometer," by Mr. E. H. Earnshaw, of Phila.; and "The removal of Tar from Water Gas," by Mr. W. C. Morris, of New York city.

Some years ago the subject of "The ventilation of gas lighted rooms" was referred to the Committe on education and research. Owing to a change in the personnel of the Committee the subject was overlooked, until it was recalled by a member of the Association at the last meeting. After studying the problem it seems impossible for this Committee to add to what Mr. Butterworth has said on the subject, for the very reason given by that gentleman, viz.: "No two cases are alike, and each must be specially studied and treated. It is impossible to lay down any hard and fast rules for universal application, as there are so many circumstances and conditions affecting the problem."

During a large part of the year, in places lying north of the 30th parallel of latitude, the heat and moisture of an open gas flame are a decided advantage.

Some work has been done during the past year for the Committee on the "Measurement of High Temperatures," and it was expected that a report on this subject would have been prepared for this meeting.

Unexpected conditions arose, however, which prevented the completion of the experiments, but it is hoped that they will be in shape next year.

Once more we give you a list of the subjects before the Committee, so no man may have the lack of a subject as an excuse for not writing a paper:

"The Measurement of High Temperatures;" "The Removal of Tar from Water Gas;" "At What Point should Coal and Water Gas be Mixed in a Combination Works to Insure the Best Results;" "The Production and Separation of Cyanides;" "The Effect of Regenerative Benches and Anti-Dips on the Production of Ammonia."

Also, the following subjects are suggested:

"Does the Ordinary Correction for Temperature and Barometer Used in Calculating the Results of Photometer Tests, Give the True Illuminating Power of the Gas?"

"What is the Effect of the Vitiation of the Atmosphere of the Photometer Room, Due to Poor Ventilation, on the Standards and the Gas Flame?"

Below will be found the reports previously referred to.

A. S. MILLER,
C. F. PRICHARD,
ROLLIN NORRIS,
A. E. FORSTALL. } Committee.

REPORT OF THE TRUSTEES GAS EDUCATIONAL FUND TO THE AMERICAN GAS LIGHT ASSOCIATION AND OTHER SUBSCRIBERS TO THE FUND.

At this point Secretary Forstall read the following relating to the matters named in the heading.

To the American Gas Light Association and Subscribers: Gentlemen—The Trustees appointed at the Twenty-sixth Annual Meeting of the American Gas Light Association, held October 19th, 1898, to administer the educational fund formed by your subscriptions submit the following report of the work, during the year from October 1st, 1899, to September 30th, 1900.

The educational work has been continued along the lines laid down in our last annual report. The Advanced Section of the Correspondence Class having finished three years' work the 19 members of this section severed their connection with the Class, January 1st, 1900. Many of these students had entered the Class when the work was first begun in 1896. Upon learning of the decision of the Trustees to limit the length of the course of study to three years, they almost without exception wrote expressing regret at having to retire from the Class, and thanking those who had given them the opportunity to increase so greatly their knowledge of the business in which they are engaged. As the same feeling of gratitude is expressed in letters of resignation received from members of the Class who are unable, from force of circumstances, to keep up the work, we feel that your and our efforts have not been entirely in vain.

The Second Section of the Class had a membership, October 1st, 1899, of 81, which has been reduced by death, resignations, and failures to answer the questions to the present number of 42. At the same time that the Advanced Section was dismissed, a new section, called the Third Section, was formed with a membership of 79. The net loss by resignation and failure to answer the questions has been 26, and the membership of this section is at present 53. These changes in the membership of the Class are shown in detail on the appended Secretary's report.

The collection of information and statistics has also been continued throughout the year. All subscribers are requested to send to the Secretary of the Board copies of all decisions of the State and Federal courts in cases of interest to gas companies that come within their knowledge, as well as information regarding any proceedings having for their object the transfer of the gas supply of towns from private to public ownership, the granting of franchises to competing companies, or the exploitation of any new process.

A few new subscriptions have been made and received during the year. The present number of subscribers is 94. The Treasurer's report, which is appended, shows the total amount of subscriptions to date, the available income and the expenses for the year, a summary of the cash account for the year, and a statement of the amount of surplus and the way in which it has been invested. Deeming it wise to lay aside as much as possible for the carrying on of the work in case all of the present subscriptions should not be renewed at the end of the five years for which they were made, the Trustees decided to set aside the surplus left over after paying the expenses incurred during the first fiscal year and all interest on investments, to form a nucleus for a permanent fund, which could be drawn upon for the above purpose. It is this surplus and interest, which, with the amounts paid in in advance by subscribers, have been invested as indicated.

Realizing and appreciating the value of the services rendered by Mr. Alex. C. Humphreys, in connection with the work of the Trustees, and being unwilling to suffer the loss of these services at the end of his term of office as an ex-officio Trustee, his fellow members of the Board have increased the number of its permanent members from three to four, and have elected Mr. Humphreys a permanent Trustee; his election to take effect at the expiration of his term as an ex-officio Trustee.

Respectfully submitted, WALTON CLARK, Chairman,
ALFRED E. FORSTALL, Secretary.

On motion of Mr. George J. Roberts, the report was accepted and filed.

REPORT OF NOMINATING COMMITTEE.

Mr. C. J. R. Humphreys, from the Committee on Nomination of Officers, recommended the election of the following:

President.—Mr. Edward G. Pratt, Des Moines, Iowa.
First Vice-President.—Mr. William R. Beal, New York.
Second Vice-President.—Mr. Alten S. Miller, New York.
Third Vice-President.—Mr. Rollin Norris, Philadelphia.
Secretary and Treasurer.—Mr. A. E. Forstall, Montclair, N. J.
Members of Council.—(Terms expire 1902)—Mr. C. F. Prichard, Lynn, Mass.; Mr. James Ferrier, Columbus, Ga.; Mr. George McLean, Dubuque, Ia.; Mr. W. A. Miller, Cincinnati, O.

ELECTION OF OFFICERS.

On motion of Mr. J. H. Keppelman, the Secretary was instructed to cast the ballot of the Association in favor of the election to office of the gentlemen named. Mr. Geo. E. Woods and Mr. T. Littlehales acted as tellers. The Secretary having reported the elections in accordance with his instructions,

PRESIDENT-ELECT PRATT'S RESPONSE

to his promotion was thus made:

Mr. President and Gentlemen: That I appreciate the great honor you have just conferred on me goes without the saying, and I accept the result of your action realizing the responsibilities of the office, and knowing full well the high standard established by those who have preceded me. Consult your memories, or cast your eyes down the list of past Presidents, from the inception of this organization to the present time, and then say that to be the successor of any of these is not worthy of the ambition of any man within the Association! I shall endeavor to the very best of my ability to make myself worthy of the office to which you have elected me, and I shall ask your co-operation and assistance to make the coming year as successful as any in the history of the Association. I thank you.

COMMITTEE ON PLACE OF NEXT MEETING.

The President appointed Messrs. Wm. McDonald, E. G. Cowdery, C. H. Dunbar, F. D. Moses and I. N. Knapp a committee to name next place of meeting.

President Ramsdell then delivered the

INAUGURAL ADDRESS.

[For President Ramsdell's Address, see JOURNAL, October 29th, 1900, page 682.]

COMMITTEE ON PRESIDENT'S ADDRESS.

President-elect Pratt appointed Messrs. W. R. Beal, Irvin Butterworth and E. C. Jones a committee to consider the Address, and report thereon at some subsequent time during the meeting.

SOME COMMUNICATIONS.

Under the heading of "General Business" the Secretary read several telegrams and letters regretting the inability of the signers to be present at the meeting, and expressing their best wishes for the complete success of the convention.

COMMITTEE ON FINAL RESOLUTIONS.

The President appointed on the above named Committee Messrs. W. H. White, H. L. Doherty, C. F. Prichard, A. K. Quinn and E. E. Witherby.

ELECTION OF DR. CARL AUER VON WELSBACH TO HONORARY MEMBERSHIP.

At this point the supplemental report of the Council regarding the election to Honorary Membership of Dr. Carl Auer von Welsbach was taken up. On motion of Mr. E. C. Jones, the Secretary was instructed to cast the ballot of the Association in favor of such election. Mr. E. G. Cowdery and Mr. W. H. White acted as tellers.

IN MEMORIAM.—GEORGE TREADWAY THOMPSON.

At this point Mr. E. G. Cowdery suggested it was a fitting time to consider formally the loss sustained by the Association in the death of their esteemed associate and beloved friend, Mr. George Treadway Thompson, late President of the Denver (Col.) Gas and Electric Company. In a beautiful speech, animated by fraternality and pregnant of sorrow, Mr. Cowdery dilated on the characteristics of Mr. Thompson. Concluding his speech, Mr. Cowdery offered the following resolution:

Resolved, As an expression of sentiment for the memory of George Treadway Thompson that the American Gas Light Association, in convention assembled in the city of Denver, does record the thought that, in the death of George Treadway Thompson this Association has sustained a deep loss. The feeling of regret is tempered by the comforting belief that his life work is an inspiration for young men.

To his sorrowing mother and bereaved family the Association offers sincere condolence.

Mr. William McDonald, speaking for the Western Gas Association and for himself personally, seconded the resolution in a well delivered speech, expressive of the loss sustained by the Association in the death of Mr. Thompson.

Mr. C. F. Prichard, on behalf of the New England Association of Gas Engineers, and on personal account as well, also seconded the resolution in eloquent vein.

Mr. E. C. Jones, on behalf of the Pacific Coast Gas Association, expressed forcefully its and his sorrow over Mr. Thompson's death. In closing his remarks Mr. Jones read the following letter received by him from Mr. Thompson some months ago: "* * * I, too, regret that I could not join with you in your recent meeting, but Association conventions have been barred to me for the past two years, and I am counting upon the coming meeting of the American here in Denver to make up for lost time. I trust you will find it convenient to meet with us then, and that there may be a goodly contingent from the Pacific Coast."

When the tributes had been spoken the resolution was adopted by rising vote.

The President then called for the

APPENDIXES TO THE REPORT OF THE RESEARCH COMMITTEE,

and Mr. Norris read the following statement respecting

THE HARCOURT 10 CANDLE POWER PENTANE LAMP.

At the annual meeting of this Association a year ago, I presented a paper giving the results of a somewhat extended series of investigations into the accuracy of the Edgerton slot and of candles as standards of light, covering the use of the Edgerton with coal gas and with water gas of varying candle power. The paper in question was not intended to be a complete and conclusive report on the entire field of photometry, but merely a sort of "Report of Progress," covering one portion of this important subject. During the past year these investigations have been carried further, and the Research Committee has considered this work of sufficient value to warrant its presentation to you at this meeting.

In the work described last year the standard of comparison was the Harcourt 10-candle power pentane lamp, the official standard of light in London, and all tests were based on the assumption that the light given out by the pentane lamp is constant under all ordinary variations of temperature, barometric pressure and humidity. Granted the truth of this premise, last year's tests showed that, as used by the ordinary practiced observer, the Edgerton slot gives a constant average light value when using carburetted water gas for any ordinary range in the candle power of the gas used. With coal gas the value of the Edgerton slightly decreases with decrease in candle power. Even with gas of the same candle power, with both coal gas and water gas, however, there was a variation in the value of the Edgerton in different observations. The amount of this variation in the light value of the Edgerton was approximately 5 per cent. above and below its average value. The variation in the case of candles was considerably greater.

These conclusions, as I have just explained, were based on the assumption that the pentane lamp has a constant light value, and the work of this year has been devoted to an examination of this assumption.

In doing this work I had at my disposal the laboratories and apparatus of my employer, the United Gas Improvement Company, and the assistance of its corps of skilled photometrists.

The observations in regard to the effect of temperature, pressure and artificial humidity were made principally by one of my assistants, Mr. Fred A. Welles, M.E., checked by Mr. C. O. Bond, the chief photometrist of the Philadelphia gas works.

In the work against the electric lamp as a standard, I was assisted by one of my associates, Mr. John B. Klumpp, M.E., and the Company's electrical engineer, Mr. Paul Spencer, M.E.

I mention these details at the suggestion of one of your Council merely to emphasize the fact that the experiments briefly described in this report were not a few superficial observations, but were carefully conducted by men of experience and scientific attainments, and cover about 6 months of more or less continuous experimental work.

In trying for the past three years or more to methodically and patiently work out to a conclusion this problem of photometry and standards, we have of course accumulated a large amount of digested data, but in this report it has seemed well to confine myself rather closely to the work bearing directly on the foundation premise of my paper of last year.

The possible disturbing elements that might effect the constancy of the value of the pentane lamp are as follows:

a. Variations in quality of pentane.
b. Deterioration of burner in continued use.
c. Variations in atmospheric conditions, as regards temperature.
d. Barometric pressure.
e. Humidity.

We will take up these possible disturbances in order.

a. *Variations in Quality of Pentane.*—In several years' experience we have found that pentane, as commercially supplied by the manufacturers for this purpose, and its quality checked by analysis, shows no measurable difference in light giving quality.

It has, however, been found that where a lamp is in constant use, and after a large quantity of pentane has been evaporated in the carburetter, the residue is somewhat heavier than the original pentane, and the light given by the lamp is slightly affected. It is necessary, therefore, to empty the residue from the carburetter occasionally and start with fresh pentane.

b. *Deterioration of Burner in Continued Use.*—Among the pentane lamps we have in Philadelphia are three which I shall call No. 1, No. 2, and No. 3.

No. 1 is used only once a day, while Nos. 2 and 3 are burned continuously night and day.

Lamps Nos. 2 and 3 were tested in 1899 against lamp No. 1, and the tests were repeated in 1900, with the following results, assuming the value of No. 1 to be 10-candle power.

Date.	Lamp No. 2.	Observer.	Average.
Oct. 25th, 1899	9.860	Bond.	9.888
Nov. 7th, "	9.915	Dashiell.	
Aug. 7th, 1900	9.860	Robinson & Bond.	9.885
Aug. 20th, "	9.909	Robinson.	
	Lamp No. 3.		
Nov. 7th, 1899	10.032	Dashiell.	
Aug. 7th, 1900	10.032	Robinson & Bond.	

In other words, almost a year's continuous night and day burning has not caused the values of these two lamps to fall off.

c. *Variations in Atmospheric Conditions.—Temperature Changes.*—In order to determine the effect of different temperatures on the value of the lamp, a standard bar photometer was equipped with a pentane lamp at each end of the bar, and the photometer room was divided by a partition so placed as to put each lamp in its own room, but at the same time not interfere with the movement of the sight-box. A small window was cut in the partition so as to allow the light from both lamps to reach the disk, and, with the temperature the same in the two rooms, the sight-box was adjusted and the comparative values of the two lamps recorded under identical temperature conditions. The temperature in one of the rooms was then raised and the lamps again compared.

The tests made covered a range of temperature of from 75° in one room to 100° in the other, and the relative values of the lamps remained practically unchanged.

d. *Changes in Barometric Pressure.*—In order to determine the effect on the lamp of changes in barometric pressure two pentane lamps were again compared, one of them being placed in an iron tank some 5 feet in diameter by 8 feet high. The tank was equipped with a glass window opposite the lamp, and arrangements were made for ventilation and a pressure gauge, and, by connecting the tank to a source of air under pressure, the "barometer" in the tank could be raised at will. The sight-box on the bar was then adjusted, and the relative values of the lamp determined when two lamps were under the same pressure. The pressure in the tank was then raised by successive increments, and the lamps again compared.

These tests showed that for a range in pressure of 1½ inches of mercury the light given by the pentane lamp remains constant.

e. *Changes in Humidity.*—The experiments made to determine the effect of humidity were both more difficult to make, and more unsatisfactory in their results. Efforts to artificially raise the humidity by the introduction of steam into one side of my divided photometer room resulted in a mist which obscured the light, and it was difficult to tell when the mist was cleared away by absorption and ventilation, without waiting until the air in the room had gotten back to practically the conditlon of the outer air. However, such results as were obtained indicated that the amount of moisture in the air affected the value of the lamp considerably, about 10 per cent., but no reliable quantitative results could be determined. We, therefore, abandoned the idea of artificially altering the humidity, and arranged to make a series of tests covering a sufficient length of time to insure a wide range of moisture conditions. Under this plan it was necessary to test the lamps against some standard whose value should be constant and entirely unaffected by atmospheric conditions.

The standard selected was a low candle power, low efficiency, incandescent electric lamp, operated by a storage battery. Resistance coils and a voltmeter enabled us to run the lamp at a constant determined voltage. An electric lamp of this character falls off in efficiency very slowly, especially if it has previously been burned long enough to settle down to its normal value.

Under the conditions of the tests the electric lamp was burned only about ten minutes a day, but in order to check against any unexpected drop in efficiency we had a number of lamps, some of which were kept as checks, and the working lamps were from time to time compared with these.

It is evident that the actual candle power of the lamp used in these experiments had no bearing on the tests, so long as the light given remained constant under the given voltage.

A dozen of these electric lamps were obtained from the General Electric Company, and each lamp was carefully standardized by the makers and marked with the direction in which the test was made, and the voltage necessary to make the lamp exactly 10 candle power.

Experiments have been made on these lines for some time, covering a range in humidity ranging from 48 per cent. to 87 per cent. of saturation, and the value of the pentane lamp has apparently varied from 9 37-candle power to 10.42-candle power, as shown in the table below, calling the average observed value 10 candle power.

TABLE I.

Temperature Fahr.	Percentage, Humidity.	Pounds Moisture in 100 Cu. Ft. Air.	Variation of Pentane Lamp Against Electric No. 3.	
72°	48	.0585	10.42	
72°	53	.0646	10.35	
74°	70	.091	9.94	10.05
70°	80	.0912	10.15	
78°	69	.1007	10.	9.00
74°	78	.1014	9.79	
80°	68	.1061	. .	
76°	87	.12	9.37	

A special voltmeter for this work was ordered last summer, but it has not yet been delivered, and we had to be content with a regular portable voltmeter. The tests made were not sufficient in number to average out the error of observation in reading this rather coarsely graduated voltmeter, and consequently the figures given above may vary slightly from the real facts, but they are sufficiently accurate to prove that the light given by a pentane lamp is affected by the percentage of moisture in the air. This may not be a disadvantage, and I will discuss this presently.

Apparently the variation depends upon the amount of moisture per cubic foot and not on the degree of saturation. The higher the temperature of air the greater the weight of water it is capable of carrying in solution, and if we heat up air of a given degree of saturation, the weight of water per cubic foot remains fairly constant, but the percentage of saturation decreases rapidly. The extent of the falling off in light value of the pentane lamp is probably dependent upon the weight of water that the flame has to heat up, and consequently the weight of water per cubic foot of air is what determines the variation. This opinion is confirmed by the results of the experiments on the effect of changes in temperature.

Two lamps were compared with both in air of 75° temperature. Then one room was heated by a steam coil to 100° and the value of the lamp was not changed. In this case the weight of the water per cubic foot of air was not seriously altered by the rise in temperature, but if the humidity was, say, 70 per cent. at 75°, it was about 34 per cent. at 100°, and yet there was no effect on the value of the lamp.

Such experiments as have been made abroad on the effect of moisture, have generally, I believe, shown the importance of this consideration, but the description of the methods has been so meager as to make it difficult to judge how much dependence is to be placed on the figures given. To summarize what I have said, it would appear:

a. That pentane is commercially obtainable of practically constant quality.

b. That the burners do not fall off in efficiency in more than a year's constant burning.

c. That the light value of the pentane lamp is not affected by temperature changes within a range of from 75° to 100° F.

d. That its light value is not affected by a range in barometric pressure of 1½ inches of mercury.

e. That its light value is appreciably affected by the amount of moisture in the air.

It is usually customary to assume that the ideal standard of light

for photometric purposes would be one which gives an invariable amount of light under all atmospheric conditions. While a standard of this sort would undoubtedly be useful, it is doubtful whether it would be just what we want for ordinary commercial use in connection with gas supply.

Experience has shown that the light given by a flame burning a stated quantity of a given gas varies if there be a change in the amount of moisture in the air supporting combustion.

It is evident, therefore, that the quality of a gas measured against a standard giving an unvarying amount of light would apparently vary with an increase or decrease in moisture in the air. In other words, if an open gas flame be tested against such a standard, the apparent quality of the gas would vary with variations in the amount of moisture in the atmosphere, even though the gas being tested remained unchanged.

If it were practicable the perfect standard against which we should compare our gas would be a sample of gas of the prescribed quality. Against such a standard any given gas would show a constant value under any atmospheric conditions, as long as the gas remained unchanged.

Of course a standard sample of gas for such use is a practical impossibility, but whatever substitute we use for this ideally perfect standard has its value measured by the closeness with which its results accord with those that would be given if the gas sent out were measured against a gas of standard candle power.

It is evident that a standard of unvarying light value does not answer these conditions. A perfect standard will be a flame which is affected by humidity to the same extent as an open gas flame would be, burning a sample of standard gas.

The indications are that the pentane lamp answers these conditions more closely than any other standard that is at present available.

It has been shown to be independent of temperature and barometric changes, but it is affected by variations in humidity. If this variation in light value equals the variation due to the same cause in the case of the open gas flame the pentane lamp is an ideal standard for gas testing purposes.

Our experience indicates that the flat flame and the pentane lamp are thus similarly affected by humidity changes, though no careful experiments have yet been made to check up this point.

In the ordinary operation of a large gas works a holder full of gas takes some time to run out and, of course, there are frequently rapid changes in humidity conditions during this time. We have never found that these humidity changes had any effect on the observed candle power of the gas, when measured against the pentane standard.

It is, therefore, fair to assume, unless and until otherwise proven, that the pentane lamp is affected by humidity, to the same extent as is the open gas flame. It would, therefore, seem that the pentane lamp fulfills all the conditions of an ideal standard for gas testing purposes.

If, on the other hand, it is desired to have a standard whose value can be expressed in absolute light units, continued experiments would give us correction factors which could be used to correct the average value of the lamp to some empirically chosen datum line of humidity, and I would suggest some other name than "candle power" for such absolute light units.

The necessity for a reliable official standard of some sort gets yearly more urgent, and I would like to see the American Gas Light Association take steps toward the adoption of the pentane lamp as the standard of candle power. This would involve some system of original lamps against which all official standards could be compared, and the certifying by some reliable authority, to the candle power of each lamp.

[To be Continued.]

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Inclined Retorts.

[A paper read by Mr. A. H. BARRET, Chief Engineer, Louisville Gas Company, Louisville, Ky., at the 28th annual meeting of the American Gas Light Association, Denver, Col., October 17 to 20.]

At the request of our President for a paper on the erection and operation of an installation of inclined retorts I submit the following:

The erection having been determined on, the first question to decide was, "How large a plant should it be;" and, then, "What units should be adopted?" To the first question, 2,000,000 cubic feet daily was decided, and, to the second, units of 100,000 cubic feet; this latter being represented by benches of 6's, with retorts 15 inches, by 26 inches by 18 feet. This length retort, when set at the adopted angle, requires a bench 15 feet, 4 inches deep, face-to-face. It was further determined to build the plant in two stacks of 10 benches each. The benches as arranged were to be 15 feet, 4 inches in width, with 22½ inch pier walls, and 3 feet, 6-inch end walls, the width of the arch being 8 feet. Upon these fixed determinations the house was p anned as follows:

The retorts were to be so arranged as to discharge toward the outside walls, this being in my judgment the most desirable arrangement. A space of 25 feet between the benches was allowed for the middle gallery or charging floor, this space being required for placing the two lines of coal hoppers overhead, as well as the two stacks, and allowing for proper ventilation. This floor is 27 feet, 9½ inches from the ground level. The outside or discharging floor was made 13 feet, 10 inches from face of bench to house wall, and 13 feet from ground level. A space of 11 feet, 3 inches was allowed at each end of the stacks for passage, stairways, etc. The above requirements called for a house having a length of 128 feet, 4½ inche , and a width of 85 feet, 4 inches.

Circumstances requiring that great economy be exercised as to cost of building, it was determined to build the house of skeleton steel construction and fill it with fireproofing of 12-inch thickness. You will find upon inspection of the prints herewith presented to you that 7-inch channels were used on the side and walls for both verticals and horizontals, with the addition of a few members of greater depth as stiffeners.

The roof is carried on the front and buckstays, which in the former case consist of two 15-inch channels, and in the latter case a box column of channels 15 inches in depth. These latter buckstays are made heavy,

as they must serve as columns as well, not only to carry the main roof superstructure but the coal bins and gas engines for working the conveyor, and the conveyor itself.

Above the coal bins and conveyor is a ventilator, fitted with louvres running the entire length of the house. In the roof over the standpipe are suitable doors, which may be raised and through which rods or augers may be passed when cleaning may be necessary. This arrangement was necessary by reason of lack of headroom otherwise for this work.

The coal bins are in two rows, one next each stack, and 9 feet 10 inches wide, 11 feet 6 inches deep, running the entire length of the benches and carrying sufficient coal to last 48 hours, represented by 280 tons. The coal bins, etc., as above mentioned, are carried on 30-inch girders, riveted to the top of buckstays. The house stands 39 feet 1¼ inches under eaves, and 71 feet 6 inches to comb of ventilator.

Benches.—The angle of 32° was adopted as being the most desirable, from the fact of my having seen good work on this slope, as also the fact that I believed I could produce, with general regularity, a grade of coal suitable to this condition.

The dimensions of each stack, as heretofore indicated, are 103 feet, 10½ inches long, 15 feet, 4 inches wide, with a height of 27 feet, 9 inches at the discharge side, and 35 feet, 6 inches at the charging side. The retorts are fitted with mouthpieces having the same angle as retorts with vertical faces. The lower mouthpieces have screw cotter, and the upper, or charging doors, have cam cotter. The lower mouthpieces average 16 inches deep, and are so made that they increase in depth from the bottom up to allow the drippings of tar to fall free. The upper mouthpieces are 7 inches deep. The lower mouthpieces have 7 inch standpipes. Each bench has a separate main and take off pipe, the latter 8 inches in diameter.

The hydraulic mains are carried over the lower or discharge end of the bench on channels, which are further used as tie rods between front and back buckstays. The height of the main from the discharging floor is 30 feet, 2 inches, leaving a clear space of 7 feet between the bottom of the main and the top of the bench for ventilation. A suitable gallery is arranged for reaching the hydraulic main, as also another on the outside of the bench for reaching standpipe.

The hydraulic main has some novel features to which I desire to call your attention. My own experience with removing the pitch or heavy tar from the ordinary main in the usual manner and maintaining the integrity of the seal has been far from satisfactory. This main is arranged in two compartments, the upper part, or main proper, into which the dip-pipes run, having the usual dip regulator, and the lower, or tar receptacle, having the tar outlet. If you will observe the drawing, you will readily understand the operation, which is as follows:

When the main is in normal working and full of water, the 8-inch cone valve which connects the two chambers is allowed to stay at the bottom of the tar chamber. The bottom of the main proper being sloping, any heavy tar, or, for that matter, any tar at all, readily runs down into the lower chamber, displacing its equal bulk of water or lighter tar and oils, or forcing them into the upper chamber to maintain the seal or overflow through the usual dip regulator, as the level of liquor may demand.

Now, periodically, which is controlled by local conditions, the tar valve is raised and held in its seat, and a small air cock connecting into the tar or lower chamber is opened, and the tar valve outlet on the bottom of the lower or tar chamber is opened, allowing the air to flow in and the tar to flow out into the usual tar trough. When the tar chamber is empty, the tar valve is closed and a water valve opened, and water allowed to flow in until it is full. Its being full is indicated by the overflowing of the air cock, when both air and water are shut off, and the tar value lowered into its normal position at the bottom of the tar chamber, ready for its next charge of tar. By this method of operation, the seal of the dip-pipe is in no way disturbed, and the main is thoroughly freed from heavy tar. The capacity of the tar chamber is about 60 gallons. Suitable hand-hole plates are arranged for periodical inspection. The mains are connected by an 8-inch take-off pipe, before mentioned, to a 16-inch main running around the entire house under the eaves, as shown on drawings.

Going back to the bench construction, you will observe that the furnaces are set well under the benches and the coke chute projects 3 feet 10 inches in front of the face of the bench. This was so arranged to produce a more even bed of fuel in charging and to make the entire fire surface accessible from the top for breaking down clinker, thereby facilitating and expediting the work of clinkering; the grate surface of 4 feet by 2 feet 3 inches, giving 9 square feet of surface, not including the stop grates.

The recuperators have horizontal flues and are provided with iron stoppers at each level. The waste gas flues from each side—two at front and two at rear of bench—are carried to a common flue under center of bench below the ash pan, and from there to the main flue, extending the full length of stack outside the wall of bench foundation, and from there to stack, which is centrally located, there being one stack for each stack of benches. These stacks are of iron lined with brick, and are 4 feet in diameter and 32 feet 6 inches high from bottom of main flue. This stack gives ample draught with 10 benches going and flue dampers more than two thirds closed. The primary and secondary air supplies have dampers at both front and back of benches.

Charging Chutes.—The coal hoppers are provided with suitable gates at the center of each bench. Below this, running on a tramway suspended from the buckstays on one side and the beam carrying coal bins on the other, is the measuring and charging chute, combined in one.

The chutes are so arranged as to be adjustable as to weight of charge, and each elevation of retorts has its own fixed charger or chute. The chutes are combined in units of threes, so that they may be filled and discharged into vertical line of three retorts. No baffle plates or regulating device other than the main valve are used. The actual time of placing a charge of 650 pounds, from the time of opening the valves until all the coal is in the retort, is 10 seconds.

Discharging Chutes.—On the lower, or discharging floor, two chutes are used; one for passing the coke through suitable openings in the floor to the coke wagons and the other for diverting the coke to the furnaces. For the comfort of the men, it is necessary that these floor openings be of ample size, as the coke frequently rushes out, when the fender is removed, in great quantities.

With an ordinarily well burned charge, it takes 15 seconds from the time the stopper is removed until all the coke is out. As a rule, the retort will not empty itself. It requires a little assistance, both from the man on the lower end to break the gorges, and by the charging man to start it from the upper end. How much this labor is you may judge from the amount of work done by each gang, which I will give later on.

Coal Apparatus—The coal as it comes from the contractor or storage sheds is delivered to a conveyor, which carries it up to a hopper, from which it is distributed to the screens, of which there are two, the first or top screen having a 4 inch mesh, and the second, three-quarters and 1-inch mesh. From the top screen all lumps over 4 inches are delivered to the first crusher, of which there are two, where it is reduced to about 4 inch grade. The balance falls to the second screen, where everything above three-quarters or 1-inch is sent to the second crusher, where, together with that coming from the first crusher, it is reduced to about three quarter inch. This then drops into a trough, where it joins that portion which had passed the second screen, and then into the boot of the elevator. From here it is elevated into the second conveyor, some 73 feet above the ground, where it is carried across the street and over an old retort house to the new retort house.

Up to this point we have but a single conveyor. Just inside the house the coal is emptied into a hopper, having suitable valves, by which it is diverted to other conveyors, running over each line of coal bins. The conveyor troughs have suitable doors, permitting the coal to be deposited at any point desired.

The conveying, crushing, and elevating machinery at the receiving end is operated by a steam engine. The conveyors to and through the retort house are operated by gas engines, located between the bins at the extreme end.

Coke Storage.—The coke as it comes from the retorts is dropped into wagons, running on rails. These wagons, having a capacity of 60 bushels, are provided with spraying pipes, placed around the inside of the upper edges and on the bottom of the wagon. The sole object of these sprays is to protect the iron work. When the cars are filled and ready to be moved they are shoved to one of the four corners of the building and placed under hoods located there, having a ventilating pipe 30 inches in diameter, extending through the roof, where the coke is completely quenched and the smoke and steam carried out of the building. These shafts also materially aid in carrying off the smoke, etc., incident to the discharging of the retorts.

After complete wetting the coke is carried to a hydraulic elevator, where it is raised to the top of the bins and distributed by suitable tracks and switches. The coke bin proper is 90 feet long, 30 feet wide and 50 feet high, and is capable of containing 22,950 bushels of lump, 11,473 bushels egg, 5,736 bushels nut, 5,736 bushels pea, and 5,736 bushels

breeze. As the lump coke is taken from the bins, it is automatically screened in passing over the chutes.

These chutes have 1½ inch holes in their bottoms, through which the small coke and breeze pass to pockets. From the pockets the residual is taken by tram car to a bucket elevator and carried again to the top of the bins, where it is assorted by proper screens into the sizes above mentioned. So that, from the time the coal is placed in the first conveyor until it is loaded into the wagons as coke for distribution, it has not to be touched by hand.

Operation.—The first two benches were charged on August 9th, and quickly followed by others until one entire stack of 10 benches was in operation in 5-hour charges, burning off 650-pound charges. The old retort house was discontinued on September 7th.

The charges are satisfactorily and evenly placed, and are easily within the control of any fairly intelligent laboring man. The only trouble experienced by me has been when the coal was too fine—that is, contained too much slack or dust—when it seems to drag and pile in the upper end of the retort. It must then be assisted by pushing with a hand rake. There also appears to be a considerable tendency to crowd or slip with this grade of coal. Using mine run coal, I have had serious trouble from this cause on not more than three or four occasions. It is essential to satisfactory working that the coal be as nearly of uniform quality as possible.

The labor as now being worked is as follows: The gangs are of 4 men each, 2 for charging and 2 for discharging. These men draw and charge 9 retorts per hour in 22 minutes average working, and I am expecting with cooler weather this gang may be able to draw and charge 12 retorts. By far the greater part of this time is occupied in filling furnaces, cleaning mouthpieces and placing fenders, as the actual time of discharging is only about 2½ minutes, based on the statement of actual time of discharge previously given. The time of charging is not to be considered, as the delay occurs at the discharging end. Figuring on 650 pounds and 5-hour charges, this would give 8.8 tons per man per day on retort house floor for 9 retorts, or 11.7 tons per man per day for 12 retorts.

The yield and candle power are about what you could expect from this grade of coal under any ordinary working conditions. In this short time of working, I am unable to state positively as to the coke, tar, and ammonia, but from evidence up to this time I shall expect the yield of tar to be materially decreased.

Many little peculiarities have developed which, when worked out and understood, can be easily controlled. One thing is, however, certain that the coal can be accurately and certainly placed and burned to any degree desired. I have so far been very slow about pushing the benches up to what I believe them capable of doing, being satisfied to go slowly and learn any peculiarities that may develop.

In closing, I desire to say that I am convinced that the gas fraternity, as a whole, is under deep obligation to one of our members who has so persistently and courageously kept the slopers before our attention in the face of most trying and adverse conditions.

The Theory of the Incandescent Gas Light.

[A lecture delivered by Dr. E. G. Love, Official Gas Examiner for the City of New York, at the 28th annual meeting of the American Gas Light Association, Denver, Col., October 17 to 20.]

The subject of incandescent gas lighting, especially in its more practical aspects, has become a very familiar topic at conventions of representatives of the gas industry, and it has also been very fully discussed in the technical journals. It is not my intention, therefore, to dwell upon the general features of the subject, but to confine my remarks more particularly to the theory of the light.

Up to the time that Welsbach demonstrated the possibility of obtaining from combustible gases a greatly increased luminosity, through the agency of the oxides of certain rare elements—the sources of these oxides were such rare minerals as allanite, gadolinite, xenotime, euxenite, zircon, monazite and others which contained ceria, yttria, lanthana, erbia, and zirconia, and thorite containing thoria—the results obtained by Welsbach made it apparent that if the discovery was to prove of any practical value it would be necessary to find a cheaper and more abundant supply of the oxides than could be furnished by the minerals just mentioned.

The need has been more than met by the discovery of extensive deposits of monazite, especially of what is known as monazite sand, resulting from the disintegration of granotoid rocks. The most productive localities at present are North and South Carolina and Brazil. In the Carolinas it occurs in the river beds and adjacent country, and in Brazil in sand banks on the seashore. Besides the monazite the sand also contains quartz, zircon, garnet rutile and other minerals, but if it contains from 60 per cent. to 70 per cent. of monazite it is considered of a very good quality.

It is a fact familiar to all that the first Welsbach burners which were put upon the market were in no way to be compared, either in the stability of the mantle, the color of the light, or the efficiency in illuminating power, to those offered the public to day. In 1886–88 it was considered a satisfactory result to get from 8 to 10 candles per foot of carburetted water gas, while now 25 to 30 candles per foot are readily obtained.

In the earlier forms of the Welsbach light the mantles were impregnated with mixtures of zirconia and lanthana, the latter being sometimes replaced by yttria, erbia or other rare oxide. The lanthana and zirconia give a white light, yttria a yellowish white, erbia a greenish, thoria a bluish white and ceria a reddish.

The various patents issued about that time covered a variety of oxides, the object evidently being to include everything which it was thought might be of advantage in the manufacture of the mantles, without any knowledge as to what combinations would give the greatest luminosity to the mantle.

The development of the incandescent gas light has naturally been a purely experimental one, and it was only after several years of research that a mantle was made which showed any decided advance in the production of a high luminosity. Still later it was found that by far the best result was obtained from a mixture consisting of 99 per cent. thoria and 1 per cent. ceria, and this may be considered as representing the composition of the most efficient Welsbach mantles of to-day.

The chemical separation of the rare oxides in a state of purity is a matter of considerable difficulty, and it was found that an impure oxide would give a better result than a pure one. Thus a mantle containing commercial or impure thoria gave 6 times as much light as when pure thoria was employed. The reason for this is found in the fact that the impure oxide contained other oxides than thoria in proportions more nearly approaching those artificial mixtures which experience subsequently showed gave greater efficiency.

In 1896 Fresenius and Hintz, after analyzing commercial thorium nitrate and also incandescent mantles, came to the conclusion either that the ceria was added directly to the impregnating solution or that a thorium nitrate containing more ceria than was to be found in the commercial nitrate was intentionally employed.

One of the interesting questions which has been raised more recently in connection with the incandescent gas light is to account for the very high efficiency given by certain substances used in impregnating the mantle, and especially the thoria ceria mantle.

I should take too much of your time were I to discuss the various theories, physical and physico chemical, which have been proposed. The names of Drossbach, Thiele, Le Chatelier and Boudouard, and others are familiar to many of you in connection with the purely physical theories of this phenomenon. It will answer our present purpose if I refer only to those physico chemical theories which are now generally accepted as most satisfactorily explaining the production of the high illuminating power of the light.

In 1896 Dr. C. Killing published an article in the *Journal fuer Gasbeleuchtung*, in which he proposed a theory to account for the luminosity of the thoria ceria and other mantles. He claimed that in order to produce a maximum of light from a thoria mantle it must also contain another substance, and that such substance should be one having more than one degree of oxidation. Ceria answers this requirement, the metal cerium having two oxides, while thoria is the only oxide of thorium. It was Killing's theory that in this case the ceria acted catalytically, or as a carrier of oxygen, thus increasing the flame temperature.

I trust that I shall be pardoned for making a digression here in order to explain somewhat in detail what this so-called catalytic action is, since upon it depends an undertanding of the theories we are discussing.

Catalysis is a term introduced by Berzelius and by him applied to the changes which sugar solutions undergo in the process of fermentation. The word catalytic is now conveniently applied to those substances which by their mere presence effect changes in other bodies without themselves undergoing any apparent change. A familiar example of a catalytic substance is the binoxide of manganese. Chlorate of potassium is decomposed with evolution of oxygen at about 700° F., but if some oxide of manganese be mixed with it the oxygen is liberated at

between 450° and 500° F., and the oxide of manganese remains unchanged. In this case the action possibly consists in the oxide of manganese taking up oxygen from the chlorate of potassium forming a higher oxide, which in time is decomposed into the lower oxide and free oxygen. There are other substances which act catalytically, not by alternate oxydation and reduction, as in the case of the oxide of manganese, but by a peculiar property they possess of condensing oxygen and other gases upon their surfaces, probably without the production of any chemical compound. Platinum is the best example of this latter class of catalytic bodies.

It is a well known fact that oxygen and hydrogen, which under ordinary conditions require a temperature of 1,200° F. to effect their combination, will, in the presence of spongy platinum, combine without the application of any heat. Döbereiner discovered this fact nearly 80 years ago and devised the well known lamp which bears his name, in which a jet of hydrogen was ignited by contact with spongy platinum. The same use of platinum in the form of platinum black is seen in many patent gas burners.

The explanation of this property of platinum is that the gases which are condensed upon its surface are brought into such close molecular contact that combination results. It seems very probable that the so-called catalytic substances do undergo a change of some kind in the process of catalysis, and it is, therefore, not strictly correct to speak of them as acting by their mere presence, although the catalytic may be found at the end of the action of the same nature as when it was introduced. Catalysis is, therefore, sometimes spoken of as a convenient fiction.

Killing supposed that in the the thoria-ceria mantle the ceria acted as a catalytic, much in the same way as the oxide of manganese is supposed to act in the case cited; that it becomes alternately the higher and the lower oxide of cerium, and that the oxygen liberated in this process increases the flame temperature and so the luminosity of the mantle. He also found that other bodies besides ceria are capable of exciting the thoria mantle. He states that one composed of 99 96 per cent. thoria and .04 per cent. platinum gives 10 times as much light as one of pure thoria, and a still better result is obtained with thoria and iridium. Gold, osmium, palladium, rhodium and ruthenium act in a similar manner, but not all bodies possessing this catalytic property are available for this purpose, as many of them are volatilized at the high temperature of the mantle.

Besides the rare oxides and the metals already mentioned, Killing tried the oxides of many of the baser metals, as chromium, iron, cobalt, nickel and manganese, all of which were capable of performing the same function in the mantle as ceria, although none of them possess the same degree of non-volatility as the ceria, nor develop the same high luminosity. That some of these are suitable for mantles is shown by the fact that the "Sunlight" mantle is composed of alumina, or alumina and zirconia, as a base, with oxide of chromium as the catalytic or oxygen carrier.

Acting on the theory of the catalytic property of ceria it was suggested that a larger quantity of ceria might be added with advantage, but such did not prove to be the case. Thus Hintz has shown that a mantle containing 99.5 per cent. of thoria and 0.5 per cent. of ceria gives 11.6 candles per foot of gas; with 99 per cent. thoria and 1 per cent. ceria the efficiency was 17.8 candles per foot; but when the ceria was increased to 2 per cent. the light per foot of gas fell to 15 3 candles, with 5 per cent. of ceria to 10 candles, and with 10 per cent. only 2.7 candles per foot of gas was obtained. Bunte explains this by saying that, on the ignition of the nitrate of cerium, a comparatively dense oxide is produced which, in consequence, becomes a better conductor, and if employed in larger quantities diffuses the heat instead of localizing it as is the case when a small quantity of ceria is used. On the other hand the nitrate of thorium on ignition intumesces in a remarkable manner, producing a very porous oxide which is a poor conductor of heat. Moreover, according to the law of Dulong and Petit, the thoria should have a lower specific heat than the ceria, which is an additional advantage. The most favorable conditions, therefore, are a body of porous, non-conducting thoria, with just sufficient ceria as a catalytic to serve to raise the temperature of the flame to a high point.

Dr. Bunte, while ascribing catalytic properties to the ceria, takes a somewhat different view from Dr. Killing of the part which this oxide plays in the development of the light. He supposes that the ceria acts, not by a transference of oxygen but that it possesses the property similar to the platinum of condensing the gases upon its surface, and that the ceria, being spread over the surface of the non-conducting thoria, effects the combination of the oxygen with the gases of the flame at innumerable points developing intense incandescence. He has fortified this position by considerable experimental work, and his views regarding the action of the ceria in the mantle, together with other conclusions to which he has come, constitute what is known as the Bunte theory.

The views of Killing and Bunte have naturally met with considerable criticism, especially from those advocating a purely physical theory. It is evident that if the same high luminosity of the mantle could be obtained under conditions entirely removed from all combustion it would be the end of the catalytic theory. Le Chatelier and Boudouard claim to have obtained as high luminosity when the mantle was heated in the hot products of the combustion of the flame as when placed in the burning gases themselves. Of course if the combustion of the gases was complete there would be no further opportunity for catalytic action. On this point Bunte reports some experiments made by Eitner in which magnesia, thoria, ceria, and the thoria-ceria mixture were subjected to an intense heat by means of the electric current without showing any difference in their light emitting power. From this it may be inferred that, inasmuch as magnesia and the thoria-ceria mixture which show such a great difference in luminosity in the Bunsen flame do not show such a difference when subjected to heat in which there is no combustion, it must be the combustion which is concerned in the production of the light from the thoria-ceria.

The researches of Döbereiner, Dulong and Thenard, and others years ago showed that platinum was not the only metal which lowered the ignition point of mixtures of oxygen and hydrogen, but that palladium, rhodium, iridium, osmium, gold, silver, cobalt and nickel also possessed this property to a certain extent. Not only the metals but certain non-metallic bodies, such as charcoal, powdered glass, porcelain, fluorspar, crystallized quartz and pumice stone were found to act similarly, but in a much less degree, requiring a certain amount of heating before this property was manifested, but that they never required heating to the ignition point of the mixture. Bunte has shown that ceria must be added to the list of non metallic substances possessing this catalytic property. He found that when thoria did not possess the power of lowering the ignition point of a mixture of oxygen and hydrogen, the presence of ceria effected the combination of these gases at 660° F. instead of at 1,200°, which was required when the ceria was not present, or a reduction of 540°.

It is probable that all solids have this property of condensing gases upon their surfaces to a greater or less extent; but it is in comparatively few cases that this condensation is sufficient to have any material effect in lowering the ignition point of the oxy-hydrogen mixture.

The "catalytic" theory thus briefly stated commands more recognition at the present time than any other which has been suggested; and whether we accept the views of Killing, or the more probable ones advanced by Bunte, relative to the action of the ceria in the mantle, the evidence is strongly in favor of one or the other as against any purely theory.

[Prepared for the JOURNAL.]

Gas Engines.

By "MACHINIST."

The efficiency of gas engines depends to some extent on piping. In the following article the writer will attempt to explain some of the reasons why gas engines do not always give good service.

In the case of both gas and steam engines the element of efficiency may be said to rest upon three factors, namely, the efficiency of the gas or steam generating power, the heat efficiency of the engine and the mechanical efficiency of the engine. In my experiences with both gas and steam engines I have noticed that the efficiency of both gas and steam generators has been perceptibly reduced by the crude method employed in adjusting the piping of the same, while in other cases the heat efficiency as well as the mechanical efficiency has been reduced. In the consideration of the piping of gas engines so as to get the best results, several factors must be taken into consideration. As a rule the modern gas engineer sees to it that the pipes are properly proportioned, that the thread works at the unions are of the best pattern, that the joints are tight and that the general plan of the piping is correct. He also takes precautions to have the best of material in the piping and connections, for he knows that the efficiency of the engine depends considerably upon the lasting properties of the pipes. In spite of all his care, however, it frequently occurs that minor troubles creep in of which the engineer has no knowledge. That troublesome element which causes so much difficulty in boilers, known as grooving, furrowing, etc., may be at work in the piping connections of the gas engine, with the result that there will be leakages and bad service. Unless the

engineer locates the trouble and knows the precise cause so as to make a remedy, he is liable to condemn the gas engine. I have known cases in which the best descriptions of gas engines have been declared defective, merely owing to some minor defect in the piping system which might have been overcome by an hour's work.

In one shop visited by the writer recently they had an engine operating some printing presses. This engine failed to give satisfaction, in that it did not develop the full power, consumed considerable more gas than it should, and required quite a liberal allowance of lubrication on the bearings. I examined the piping connections of this engine and noticed that in several places there was excessive leakage. The odor of gas was plainly evident in the rooms of the shop, but it never seemed to have occurred to the machinists of the printing office that the gas leaked from the piping connections. At one connection enough gas leaked out to permit a flame to be started with a lighted match. At this point I found the old story illustrated of the concealed grooving and furrowing of the threads of pipes. This is sketched in Fig. 1. Thread *A* is perfect, but threads *B* and *C* were found to be quite badly scored, to such an extent as to permit the gases to escape at that point.

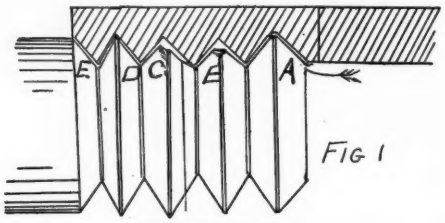


FIG 1

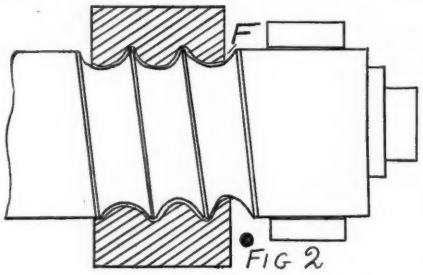


FIG 2

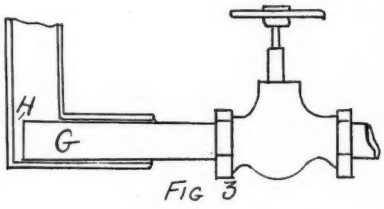


FIG 3

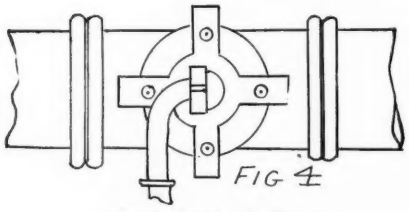


FIG 4

Concerning the Piping of Gas Engines.

The fact that threads *D* and *E* are not affected does not materially alter the conditions. If there are a dozen or more threads in a joint, and only one or two are scored off, broken or otherwise defective, leakage of gas at the joint may not occur. But if there are only four or five threads, and half of the number are out of service, the chances are that the gases will find an exit over the remaining ones and then we have just such a leak as the writer noticed in the machines at the printing office. The trouble in this instance was overcome by removing the connection and cutting new threads, after which the joint was replaced and the leaking ceased. The efficiency of the engine was then brought up to its rating. In another shop I observed a series of piping put in with reducers, and over all was the rounded thread union *F*. These round threads can seldom be made tight. It is not often that they are found in actual service, for there are not many tools in use that are suitable for cutting these forms of threads. In cases where this type of thread is found, and the efficiency of the engine is affected through successive leakage of the gases, the best way out of the trouble is to substitute the regular threads by cutting over the original, or by using new pieces.

Simple Things Often Cause Much Trouble.—In a machine shop where they had several gas engines engaged for operating independent special machines, one of the engines failed to give good work, while the others of the same make operated perfectly. Notwithstanding this, the local engineer attributed the trouble to the engine. Upon investigation it was found that the loss of power in the engine was due to the fact that one of the pipe joints at an elbow was made as shown in

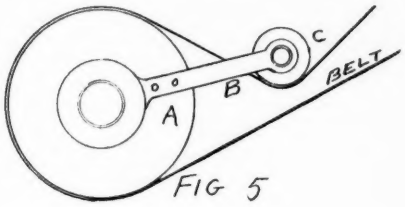


FIG 5

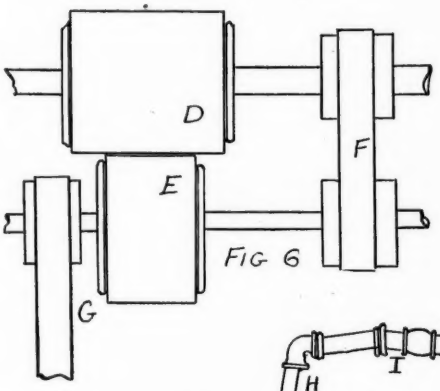


FIG 6

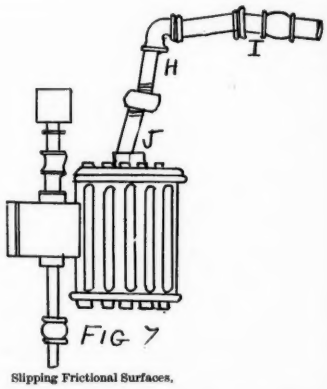


FIG 7

Slipping Frictional Surfaces.

Fig. 3. The inner pipe *G*, was turned so far into the elbow that there was a very little space left at *H*. The passage was stopped fully one half and it was of course the same as shutting off the gas supply to that extent. In most cases the gas engines of American manufacture are of superior construction, and very few apprentices are employed in the making of the parts or of putting the parts together, as is the case in some of the European shops. But the best manufacturers of gas engines cannot overcome the difficulties which are brought about by the careless method employed by some of the pipe fitters who are engaged in setting up and starting gas engines.

Some of the larger manufacturers of gas engines are very careful about this matter, and have men employed for no other purpose than to go to establishments where new engines are being put in for the pupose of seeing that the engines are properly set up and piped. These inspectors prevent considerable future trouble by offering the suggestions resulting from long experience with the engines. In one place where they were putting in an engine for the purpose of running some wood working machinery, the local pipe fitter and machinist connected an air vent to the main gas pipe in the manner shown in Fig. 4. No such vent was required, and the mode of connecting it is of course exceedingly wrong. Instead of putting a tee in the pipe for the purpose of making a proper connection with reducers to the proper sized pipe, the men bored a big hole in the pipe, clamped on a disk with threaded head into which an elbow was turned and a pipe dropped. as shown. It was a useless affair and served only to create trouble. It was removed and the pipe plugged.

While examining the piping of gas engines with a view of locating certain difficulties which are preventing the engines from developing the proper efficiency, it is a good idea to look into the belting. In a brick making plant in which they were using gas engines for power purposes, one of the connecting belts slipped a great deal on the driver and driven pulleys with the result that the motion of the engine was irregular. At first it was supposed that the engine itself was defective, and I was informed that the machinist of the plant had spent considerable time in overhauling the parts and making new adjustments without improvement. Finally, after trying the driving belt both tight and loose, without apparent alteration, the machinist conceived the idea of putting on an idler pulley, in the manner shown at *C*, Fig. 5. This pulley turned in the arm, *B*, a stud for which was screwed into the end of the arm. The arm was arranged to secure its hold fo position on the belt pulley shaft, as at *A*. This idler took up the slack of the belt and seemed to increase the efficiency of the engine in that it prevented the belt from slipping and, therefore, the loss of power through slippage stopped. It is better, however, to have the idler attached to some other part than the pulley shaft. The idler should be on bearings which are sustained in a separate bracket or stand.

Smooth Surfaces.—Of recent years they have been introducing ordinary friction wheels for service in connection with gas engines. In Fig. 6 is the plan seen in some places, although there are different arrangements. In this plan, the driving belt is marked *G*, the friction wheels of iron *D* and *E*, and in addition there was a belt operated at *F*, for the reason that the friction wheels of iron failed to run well and the machinists put on this additional belt to help them along. When I saw the outfit it was running well, because most of the work was done by the little belt at *F*. The trouble with the iron friction wheels was that they were not properly proportioned. The upper wheel is too large for the smaller one, and there is loss of frictional surface thereby. Again, the belt *G* had a tendency to pull down on the one side of the wheels, causing that side to bind with reduced force and lose grip. The hangers were arranged so that the bearings came just outside each of the pulleys. There should have been a hanger set in between, for these friction wheels require extraordinary support. The surfaces of the iron wheels were gummed, for, at one time, evidently, some one had supposed that the wheels should be provided with a dressing, and this soapy dressing was plain to be seen. The wheels were scraped off, the big one removed and turned off on one side to the same size as the small one, the belt *F* and pulleys removed and new hangers put. up, so as to sustain the friction wheels with great firmness, after which the system operated as the manufacturers intended it should.

Slapping Pipes Together.—In Fig. 7 is shown a sample of the way in which some machinists slap pipes together on gas engines. This drawing was made direct from an actual case in which the efficiency of the engine was reduced fully one-half, and the atmosphere kept saturated with the odors of gases, merely because of the numerous leaks occasioned at *I*, *H* and *J*. In cases of this sort there is only one remedy, which is to remove the complete setting of piping and substitute new,

"Outdoor Work" in Manchester, England.

A representative of the *Gas World* recently interviewed Mr. W. C. Waddington, Superintendent of the Street Mains and Lighting Department, Corporation Gas Works, of Manchester, England, the object of the interviewer being the obtaining of knowledge respecting the placing and maintaining of mains, etc., on account of the Works. Carrying on the story as the same is printed in the *Gas World*:

Main Laying.—Invited to give the benefit of some of his experience in regard to main laying, Mr. Waddington said: "The laying of gas mains in a large city like this is a very different affair to what it was a few years ago, when only a running trench from 2 to 5 feet deep, according to the size of main, had to be cut, and the pipes laid. Now it almost becomes a feat of engineering skill to get through the tangle of hydraulic and water mains, telegraph and telephone pipes and chambers, electric mains and culverts, etc. The telephone system, in particular, is very awkward to avoid, as on the heaviest circuit there are upwards of twenty 3-inch cast iron mains grouped together, to accommodate the great number of lines required. This is a very formidable barrier indeed. It will therefore be seen that in laying a main of large diameter it is absolutely necessary to have a plan showing the exact position of all the various pipes, etc., on the route. The selection of the right track for your proposed main is an important matter, for if, in order to avoid the whole network of pipes and wires, you lay your main deep you will in all probability be suddenly pulled up by the crown of a sewer appearing in your cutting, and most likely in a busy thoroughfare. To give you an idea of the vast system of underground mains in a large city, there are at the present time within a quarter of a mile radius of the Town Hall about 5,000 tons of cast iron pipes."

How Interruption of Traffic is Avoided.—In Manchester, as in so many other places, the streets in the centre of the city are much too narrow for the volume of traffic, with the result that the breaking of them up is a more inconvenient matter than where the streets are wider. Asked whether it was possible to do anything in the way of minimizing this inconvenience, Mr. Waddington replied: "The question of disturbance of the streets through taking them up is, I know, becoming acute here, and any improvement on the old methods of main laying, such as would diminish the inconvenience, is to be regarded as a step in the right direction. I may say that of late, in crossing thoroughfares with a trunk main, where there is a heavy and continuous traffic throughout the day, I have adopted the plan of putting in a temporary subway during the night, after the last tram car has passed, and hauling the pipes along the heading from the other side of the road. We get down just a foot below the surface and put in iron girders; then we replace the roadway before the time comes for resuming the street traffic, and we afterwards push ahead with the work. This plan was adopted recently with a 36-inch main that was being taken across the city, with the result that there was no interruption whatever of either vehicular or pedestrian traffic, and people passing along during the day could never have suspected the busy scene that was being enacted under their feet."

"The 36-inch main," it was explained in answer to a further question, "is an entirely new main, we have constructed during the past twelve months for the purpose of connecting our Bradford Road and Gaythorn stations, which are about two miles apart. That was an idea of Alderman Gibson, the Chairman of the Gas Committee, and it has proved a very valuable one. The main enables us to send any surplus gas down from our largest station, that at Bradford Road, to the Gaythorn station in the centre of the city, where the largest demand takes place, the gas being sent thither either by an exhauster or by the action of the holders. As we don't like too large pressures in the town we find it is safer to work with the exhauster."

Distribution.—Mr. Waddington smiled complacently over the next question put to him, which had reference to the steps taken to induce property owners to see that gas pipes are put into all new houses. "We have no occasion to do anything in that direction," he made answer; "pipes are put into every new house, almost without exception, without any intervention on our part. We have a system under which the authorized gasfitters who do such work give notice to the Indoor Department when the pipes inside the walls are ready for inspection, and as soon as such intimation is received, which is generally before the flags are put down, we make arrangements for the laying of the main. In deciding as to the size of the main we have to form a judgment as to the probable consumption of gas, and in doing that we have always, of course, to look a few years ahead."

On the question of varying pressure, he said: "What I have said in

regard to the change in methods of main laying applies also to distribution, in consequence of the greatly extended use of gas for purposes other than lighting. The use of gas engines for producing the electric light in warehouses and other large places of business has very much increased. At the end of March we had 1,488 gas engines being supplied with gas from the corporation mains. During the lightest and hottest period of the year power is required, during even the midnight hours, for refrigerating and other purposes, and in order that this demand may be properly met small portable pressure registers are attached to the mains in certain positions, and these are regularly inspected. The result of all this demand for gas for non-illuminating purposes is that practically a uniform and steady pressure is required for the whole 24 hours. During the day we supply at a pressure of not less than 1½ inches, although, of course, the pressure varies according to the altitude of the district. During the time of full lighting we increase the pressure by only a tenth or two-tenths."

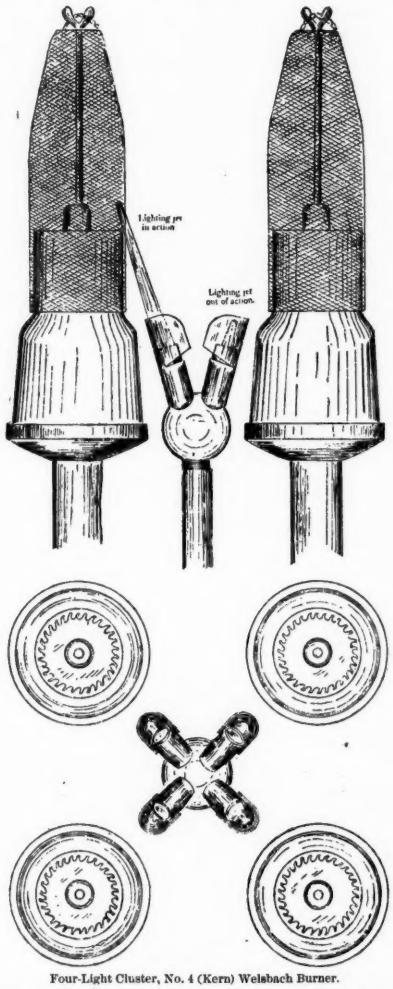
Unaccounted for Gas: Some Useful Hints.—On the vexed question of electrolysis Mr. Waddington was drawn blank. The matter is being investigated by a joint sub committee of the Gas and Electricity Committees, and pending the publication of their report he thought it undesirable that he should say anything. On the subject of unaccounted-for gas, however, he proved prolific. On this theme he discoursed thus: "Three, four, or more per cent. of unaccounted-for gas does not, of course, by any means imply that that amount of gas has actually escaped into the earth from the pipes, or into the air from the holders. There are other ways in which the difference between the amount of gas made and that sold can be explained. In the first place there are the consumers' meters, which are stamped as correct, and allowed to be 3 per cent. slow or 2 per cent. fast—a difference of 1 per cent. in favor of the consumers. Then there is the difference between the temperature of the gas as sent into the holders and that registered at the consumers' meters; a difference of 5° F. is responsible for a rise or drop in the bulk of the gas of 1 per cent. Condensation, both in the holders and the mains, as readers of the *Gas World* know, also plays no unimportant part in the matter. A low leakage account is, of course, an important factor in any gas undertaking. It is therefore desirable to consider the best means to adopt to bring this about. As regards the mains I am of opinion that a vertically cast iron pipe, of uniform thickness of metal, with joints turned and bored to gauge, has no equal. Mains have been taken up which have been in use over thirty years, and it has been found that the joints were positively the soundest part of the pipe. This, I think, is pretty good evidence that an iron joint is not injuriously affected by the expansion and contraction of the pipes due to the difference in the temperature of the ground in the winter and summer seasons. A minimum depth of two feet to the top of the socket is not too great for either small or large mains, and taking into consideration the present changed conditions of supply, and the increasing use of gas for purposes other than lighting, which necessitates both larger and more frequent tapping of the mains than formerly, I think it would be a wise thing to increase the minimum size of cast iron mains from the three inches, which is at present considered prudent, to four inches except in special cases or in the case of small property.

"There is another matter closely connected with a leakage account and one which cannot too often be mentioned to the pipe layers engaged in laying open socket pipes with lead joints. They should not expose the pipes for any lengthened period to extreme temperature. Very serious leakages are caused by leaving the pipes fully exposed for several hours to the rays of a midsummer sun, and then laying them in the trench. When the filling in is done the process of cooling down begins, and contraction takes place, with the result that the shrinking of the two metals, lead and iron, not being equal, a leaky joint inevitably follows. Even the most experienced pipe layers will omit the precautions of keeping the pipes in the shade and partially filling in the ground as soon as laid.

"The combined drill and tap is a most useful tool and a real economizer of gas in making the service pipe connections to the mains. Once this has been used, the old-fashioned drill rhymer and tap will be discarded in drilling live mains.

"Too much attention cannot be given, I consider, to the service pipe branch of the work and to the adoption of the tube best suited for the purpose. Owing to the greatly inferior power of wrought iron in comparison with cast iron in resisting ground action a preserving material is of no small value. Various tubes and preserving solutions have been tested over a period of many years, with the result that it has been found that a wrought iron tube of specified thickness, with fittings to match, which has received a coat of paint before leaving the tube works, to prevent corrosion setting in during transit, and which when laid has a tar preparation well brushed over the whole length, care being taken that no part of the service is omitted, is in ordinary ground practically everlasting, and will give no trouble until it is taken up for alteration or for the substitution of a larger service. Even in that case the tube is cut into various lengths, screwed, and again used as 'shorts.' Some little inconvenience was at first experienced with the tube most in use, as it became a 'bastard,' but this soon remedied itself, and the thread is now well known as the ¾" Hy. B. size."

Naphthaline.—Mr. Waddington is not provided with any panacea for the naphthaline trouble. That, he thinks, is chiefly a matter for the engineer who has to do with the manufacture of gas and the sending of it out from the works. As a distributing engineer he explained what is done to remove the crystals when they have been deposited. "As a rule," he said, "we pour naphtha down the service pipes and also the meter connections, and we have frequently to pour it down the mains as well. We also find that hot water and steam clear the mains very rapidly; and naphtha being so very inflammable it is safer to employ hot water and steam in confined places. The hot water and steam are applied by means of a large portable kettle. By such means we remove the naphthaline; it may form again, but not to any great extent."



Four-Light Cluster, No. 4 (Kern) Welsbach Burner.

Street Lighting: A Useful Device.—The lamps with which the streets of the city are lit include over a thousand fitted with "C" and

Kern burners, in groups of two or three or four, according to the importance of the street dealt with. Experiments have recently been made with 4-light clusters of Kern's, in globular and hexagonal lanterns. In the hexagonal lanterns an antivibration arrangement is employed; the globular lanterns are suspended on posts which are familiarly known as of "the swan neck" design. The results obtained have been entirely satisfactory, but the further consideration of the extension of the incandescent system is, it appears, in abeyance for the present, as the Electricity Committee have in contemplation a scheme for lighting the principal thoroughfares from the center poles carrying the wires for the electric cars which are to be put on the tram lines as soon as these are taken over, as they will be shortly by the Corporation. In certain towns this generation of current for power and for lighting purposes conjointly has been pronounced uneconomical and unsatisfactory. There is for consideration the further que tion of the better results obtainable from incandescent gas. It may be hoped that these points have not escaped the attention of the Manchester Corporation Gas Committee, as it is clearly undesirable that the Electricity Committee should be allowed to act in the matter according to the dictates of their own sweet will."

Mr. Waddington, as the interview was concluding, brought under notice an arrangement for which it is claimed that it is proving useful in the way of lengthening the life of the mantles employed in incandescent lighting. Producing a globular lantern containing the device referred to, Mr. Waddington said: "It is generally supposed that the pilot light impinging on the mantle has a tendency to damage the mantle, and as you will see we have here a special by-pass for the group of four burners, with the object of preventing this injury to the mantles. The pin-head pilot light is always kept burning, but it is enclosed in a metal covering. By a special tap at the bottom of the lantern, which can be operated by the lamplighter, the flame can be shot out and lengthened to impinge on the mantles momentarily. Then the tap is closed again and the flame disappears from view. We have had the apparatus in operation since Christmas and find it serves its purpose very well indeed."

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

We have pleasure in formally announcing the marriage of Thomas Turner to Ellen Quarmby Turner, both of Charleston, South Carolina. The marriage ceremony was performed at home, noon of October 17th, the Reverend H. E. Cornish (assisted by Robert Wilson, D.D.) officiating. The bride is the charming daughter of Mrs. S. H. Quarmby, and the groom is the gentleman so well and favorably known to the gas industry through his long and honorable connection with the management of the Charleston Gas Light Company. Good luck, and much of it, to them.

Mr. E. W. T. Richmond, the forceful and resourceful head of the important gas apparatus manufacturing firm of Richmond & Co., of Warrington and London, England, is on a visit to this country. He will remain for several weeks, and it is more than likely that the main part of his time will be taken up examining into American ways and means of spreading the sale or encouraging the hire of gas cookers, heaters, etc. He is quite a bit on the order of an American himself, in respect of his ways of conducting business.

Messrs. Deily & Fowler, of the Laurel Iron Works, Phila., have been awarded the contract for the construction of a gasholder, to rest in steel tank, for the Citizens Gas Company, of Jacksonville, Fla. The holder is rated to a capacity of 250,000 cubic feet.

A correspondent in Chicago, writing under date of October 25th, says: To the Editors American Gas Light Journal: You have probably had telegraphic reports of the explosion which took place in the works at Mattoon, Ills., last Saturday. For your better information I would like to say that while the explosion resulted in considerable injury to the purifying house—a one story structure—no serious damage was done to any machinery or apparatus. There was no stoppage in the supply of gas, and within 5 hours after the explosion the making of gas was restored. Only one man was injured, but not seriously, his injuries consisting of burns about the face and hands.

The American Bridge Company is furnishing, from its Minneapolis plant, the structural steel for the roof of the State Hospital at Glenwood, Iowa.

The proprietors of the Florence (Ala.) Gas Light and Fuel Company have applied to the City Council for the right to construct and operate an electric lighting plant.

Mr. Augustine H. Rankin, Chairman of the Board of Tax Assessors, of Woonsocket, R. I., died at his home in Woonsocket the evening of October 20th. Deceased was identified with the Woonsocket Gas Company, having served it as a Director for several years.

At a meeting of the shareholders of the St. Joseph (Mo.) Gas Company the officers chosen were: Directors, W. H. Douthirt, W. A. P. McDonald, James Campbell, C. A. Pfeiffer, S. C. Woodson, H. R. W. Hartwig, L. C. Burnes, Milton Tootle, Jr., and H. Wyeth; President, W. F. Douthirt; Vice-President, W. A. P. McDonald; Secy. and Treas., F. Labrunerie; General Manager, K. M. Mitchell.

Mr. Samuel R. Bullock has disposed of his holdings in the Peoples Electric Company, of Sandusky, Ohio.

Messrs. R. M. Grindley, I. C. Baxter and H. B. Smith have applied to the authorities of Delray, Mich., for the right to operate there a gas and electric lighting plant. They ask for a 30 year franchise period, the authorities to have the right, at intervals of 6 years, to take over the plant for operation on public account, and they agree to sell gas at a price not to exceed $1.75 per 1,000 cubic feet on illuminating account, the charge on fuel account supply not to exceed $1.50 per 1,000. Delray is virtually a suburb of Detroit, it being only 3 miles northwest therefrom.

In the reorganization of the Newton (N. J.) Gas Company, the taking over of which by Mr. Frank Hughes and Mr. William McKenzie, of Passaic, N. J., was reported a short while ago in the Journal, the following officers were named: Directors, William McKenzie, Thos. M. Moore, Frank Hughes, A. S. Prescott, D. R. Hull, J. M. Hays and Ira C. Moore; President, W. M. McKenzie; Treasurer, Frank Hughes; Secretary, C. C. Hartpence. The new owners will at once reconstruct the manufacturing plant, and later on vigorous attention will be bestowed upon the distributing system. The Treasurer of the Company, if all signs do not fail, will be heard from again in connection with the gas business.

Mr. Bradley H. Phillips has been appointed Receiver for the Medina (N. Y.) Gas and Electric Company. His duties may be prolonged but they will not be arduous.

Mr. John J. Knight, Vice President and General Manager of the Kalamazoo (Mich.) Gas Company, denies that the proprietors of his Company have purchased the franchise of the to-all-intent defunct Kalamazoo Gas and Electric Company. He admits, however, that whenever the owners of the latter concern are willing to sell whatever pipe they have in the ground it is possible a trade may be made.

It is said that certain residents of Peru and La Salle (Ills.) have petitioned the City of La Salle to revoke the franchise under which the Peru-La Salle Gas Light and Power Company is transacting business. The petitioners claim that they have sustained "financial loss on account of the lack of gas on several occasions having obliged them to close their stores."

About a fortnight ago the Trustees of Harlem, Ills., granted a franchise to the Cicero Gas Company to supply gas in that village. The President of the Trustees (Arthur Kistenbroker) vetoed the franchise, and the Trustees, at their meeting on October 27th, passed it over the veto. One of the Trustees (Mr. Gotsch) plaintively remarked, after the repassing vote was announced, that it was the first bill ever passed by a Harlem Board over a President's veto. Mr. Gotsch, however, should remember that everything must have a beginning.

The Board of Gas and Electric Light Commissioners, of Massachusetts, having heard the arguments in respect of the application for a revision of the rates charged by the Springfield Gas Light Company, handed down an order that the gross charge should not exceed $1.05 per 1,000 cubic feet. This would seem to mean a cut of 20 cents per 1,000.

The Municipal Gas Company, of Albany, N. Y., is paying a dividend for the last quarter of 2½ per cent.

THE owners of the Youngstown (Ohio) Gas and Electric Company, and of the Kaercher Electric Company, have agreed to consolidate, the amalgamation and transfer to be formally made January 1st. Mr. Randall Montgomery, the General Manager of the Youngstown Gas and Electric Company will remain as Manager of the consolidated enterprise.

THE Directors of the Lynn (Mass.) Gas and Electric Company, at a recent special meeting, adopted the following resolutions respecting the memory of the late Mr. John G. B. Adams, for a number of years one of its Directors:

The Directors of the Lynn Gas and Electric Company, reflecting upon the death of one who has for 12 years past been so intimately associated with them in business and social life, and realizing the great loss which has befallen not only them, but that unnumbered host whose great pleasure it was to call him their friend, pay to his memory this last tribute of friendship and respect.

Resolved, That in the death of our beloved associate, John G. B Adams, this Board and this Company have sustained a loss which can not be fully appreciated and realized until in after days we meet and miss that familiar form which ever brought into our midst good cheer and good fellowship, and that voice which was never heard save with words of good advice and commendation.

Entering this Board at a time when, to the Directors of the Lynn Gas Light Company, it appeared that the interests of that Company and the Lynn Electric Lighting Company, of which he was a pioneer, together with the public, would be best served by a consolidation of both Companies, he brought to the service of the Company a mind well trained to grasp and carry to a successful issue the many problems with which it has been confronted. As an associate the memory of his many words of advice and encouragement will remain in the minds of his fellow Directors as a precious remembrance of one who was ever their beloved companion.

As a friend, one whose delight it was to do good, his memory will be more fully cherished. It has been truly said of him that he loved to oblige his friends, and they and those with whom his daily life has brought him into close contact constitute that great body of sincere mourners who, to-day, with sorrowing hearts, reflect upon their great loss. Such a life as his has been is well worth living, such a death has its recompense, for, although leaving behind sorrowing friends and relatives, it also leaves a train of pleasant memories which shall remain as long as the lives of his sincere mourners shall be spared.

We mourn with his family in their affliction and tender to them our heartfelt sympathies.

LAST winter the Council of Lehighton, Pa., leased its electric lighting plant, which had been operated there for some time on municipal account, to James I. Blakeslee. At the time of the leasing Blakeslee had inserted in the contract this clause:

"No franchise shall be granted by the Borough to any individual, firm or corporation that will increase the cost of producing light or place additional expense upon the said James I. Blakeslee, by reason of damage to the property."

Some weeks ago Mr. W. H. Fritchman and W. E. Ash applied to the Town Council for the right to operate a gas works in Lehighton, and they are meeting with stout opposition from Blakeslee and his friends, who assert that the clause above reprinted from his lease binds "the town to hold him blameless from competition."

THE authorities of Napa, Cal., have entered into a contract for the public lighting of that place, in so far as it is performed by arc electric and gas lamps, with the Napa Gas and Electric Company, for one year from the first inst. The Company submitted the following bid: 30 arcs from Nov. 1st to May 1st, moonlight schedule until 1 A.M., for $300 per month; extra lights at the rate of $9.50 per month; 20 arc lights, from May 1st to Nov. 1st, at $10 per month; 50 gas lamps, all night and every night, from Nov. 1st to May 1st, and 10 from May 1st to Nov. 1st, at the rate of $3.75 per light per month.

THE franchise for the operation of a gas works for the joint supply of DeKalb and Sycamore, Ills., having been granted, construction work will be commenced forthwith. The promoters are bound to commence construction within one year and with at least three miles of mains in use. The maximum price of gas is fixed, the sum not to be more than $1.75 for lighting and $1.50 for fuel. The city of De Kalb is to have 100,000 feet of gas free each year to light its public buildings.

THE following, from the Washington (D. C.) *Star* of October 26th, is given for what it is worth: District Commissioner Macfarland to-day received from Dr. S. Calvert Ford, United States inspector of gas and meters, a reply to his letter of the 24th instant, informing the Inspector of the complaints received recently by the Commissioners of the poor quality and power of the gas supplied here. The Inspector expresses the opinion that the cause of the trouble is not due to any neglect of the Gas Company, but rather to a deposit in the pipes of what is known as naphthaline. He informs the Commissioners that should they favor him with the names and addresses of persons lodging complaints with them, he will see that they receive attention. Dr. Ford's communication reads as follows:

"On several occasions recently the gas supplied by the Washington Gas Light Company from the northwest works, corner of 26th and G streets northwest, has been of low standard, as my daily reports will show. But please remember that with Washington gas an average is taken by the results at all thre stations. I think the cause of the trouble in the fall of the year is due to the low temperature of the past few weeks, and this is the reason why in many instances where stoppages occur it is due to the formation of naphthaline, a hydrocarbon, which forms in the inlet and outlet of meters, and if not attended to promptly will stop the flow of gas completely.

"I do not think that the cause of the trouble that the Washington Gas Light Company have to contend with is due to any neglect on their part, but is simply due, as I have said before, to the deposit of naphthaline, which blocks up suddenly and without warning the pipes and services supplying the consumers' premises. Should you favor me with names and addresses of the persons complaining I will see that the complaints receive attention."

With his letter Dr. Ford transmitted one which he received from Mr. John Leetch, General Manager of the Washington Gas Light Company, relative to a complaint made to the Commissioners several days ago by Mr. Alfred L. Leonard of 3317 17th street. This complaint of Mr. Leonard was published in the *Star* at the time, it being charged by him that the gas supplied at his residence has been of not only poor quality, but that the pressure has been so weak that more than once lights have gone out. The same condition of affairs, said Mr. Leonard, has been experienced by some of his neighbors. Mr. Leetch's letter was as follows:

"In reply to the complaint of Mr. Alfred L. Leonard, of 3317 17th street, as to the quality of gas furnished at his residence, we would report that we have made a careful investigation of this matter and find the following as the probable cause of the diminution of the flow of gas during the early hours of the evening. Mr. Leonard's house is situated at the extreme end of our main and at the bottom of 17th street, very low down. As a result of this, when the consumption, including street lamps, is begun in the evening the pressure is decreased at Mr. Leonard's residence until about 8 or 9 o'clock. To remedy this defect we have applied to the District Commissioners for a permit to lay a 6-inch main along 16th street extended, in order that we may furnish a full supply of gas to Mr. Leonard and all others in that vicinity."

The permit for which the Gas Company had applied, it is stated, is for a main on 16th street, from Columbia road to Park street, and it is probable that it will be granted. It will be observed from a comparison of Dr. Ford's report with the letter to him from Mr. Leetch, that they do not appear to agree as to the cause of the trouble experienced by the consumers of gas. Dr. Ford attributes it to the formation of naphthaline, while Mr. Leetch thinks the trouble is due, in Mr. Leonard's case, to the location of his house and to the evening consumption of the gas.

Commissioner Macfarland, who has immediate supervision of the matter, stated to day that he will see that all complaints made to the Commissioners are at once forwarded to Dr. Ford, and will request the inspector to inform the Commissioners of the results of his investigations of all such complaints. Dr. Ford's request that the Commissioners forward to him all complaints received by them, Mr. Macfarland thinks, may be taken by citizens having reason to complain as an invitation to send their complaints direct to the Inspector. If this be done the Commissioners will also expect Dr. Ford to transmit to the Commissioners the result of his investigation of these complaints as well.

When asked whether the presence of naphthaline in the inlets and outlets of meters, referred to by the Inspector, amounts to a lowering of the lawfully required standard of the gas. Mr. Macfarland said he is unprepared to say. He said, however, that he proposes that the Inspector shall make all this perfectly plain, and gave assurance that he and his associates will do all they possibly can in the matter, that the people of the District shall not only receive gas of the standard required by law, but that the pressure shall, if possible, be such hereafter as to remove ground for complaint on that score.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 32 Pine Street, New York.

The JOURNAL is the official organ of the
NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.
AMERICAN GAS LIGHT ASSOCIATION.
WESTERN GAS ASSOCIATION.
OHIO GAS LIGHT ASSOCIATION.
PACIFIC COAST GAS ASSOCIATION.

TERMS:

SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 Cents.

Notification Respecting Advertising.—Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co. 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, NOVEMBER 5, 1900.

The Market for Gas Securities.

Uncertainty prevailed last week in local gas share trading, with weakness as the underlying characteristic. The transactions were small and rumors were few. Consolidated sold at something under 173 to-day (Friday), and the close was made at 173 to 173¼. Standard common is reported to be offered at 133, but we imagine that not much of it outside the clique at present could be obtained at the figure named. There is nothing particularly startling to report in connection with the business of the city "gas companies," unless reports of continued good output may be so considered. All city gas bonds are in good demand.

Brooklyn Union opened this morning at 170 bid, and we ask our readers to remember our prediction of a month or so ago as to the figure this stock would likely sell for before the first of the year. The general market for gas shares shows the continued confidence of investors in this particular line of property holding. Washington (D. C.) is 270 bid, and Baltimore Consolidated is 53½ to 54¼. The leaven in respect of the rise in the latter shares is working well.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

NOVEMBER 5.

☞ All communications will receive particular attention. ☜ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$54,595,200	100	173	173⅛
Central Union, Bonds, 5's..	3,000,000	1,000	106	107½
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	120	..
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	298	305
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co.. Bonds, 5's	11,000,000	1,000	105¼	106
Northern Union, Bonds, 5's.	1,250,000	1,000	104	104¼
New York and East River.. Bonds 1st 5's	3,500,000	1,000	106	106⅝
" 1st Con. 5's	1,500,000	..	115	.
Richmond Co., S. I.	348,550	50	70	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	130	133
Preferred	5,000,000	100	150	153
Bonds, 1st Mortgage, 5's	1,500,000	1,000	116	114
Yonkers	299,600	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	170	172
" " Bonds (5's)	15 000,000	1,000	116	119
Bay State	50,000,000	50	1¾	1¾
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	25	28
" 1st Mtg. 5's	475,000	1,000	90½	92½
Boston United Gas Co.— 1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	..	4½
" " Bonds, 5's	5,250,000	1,000	63	65
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Central San Francisco	2,000,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati G. & C. Co.	8,500,000	100	191	192
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,207,000	1,000	106	107
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	60	65
Preferred	3,036,500	100	84	86
Consumers, Jersey City Bonds	600,000	1,000	103	105
Consumers, Toronto	1,700,000	50	215	216
Consolidated, Baltimore	11,000,000	100	53¾	54¼
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N. J.	1,000,000	100	11	14
" Con. Mtg. 5's	880,000	1,000	80	85
Consolidated G. & E. Co.'s., Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co.	4,560,000	50	91	100
" Prior Lien 5's	4,598,000	1,000	99½	100
Detroit Gas Co., 5's	386,000	1,000	100	101
" Inc. 5's	16,000	100	94	94½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	35	40
Fort Wayne	2,000,000	..	35	41
" Bonds	2,000,000	..	60	64
Grand Rapids Gas Lt. Co..	1,000,000	50	105	107
" 1st Mtg. 5's	1,125,000	1,000	..	..
Hartford	750,000	25	..	230
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	72	82
" Bonds, 6's	2 650,000	..	98	100
Jackson Gas Co.	250,000	50	70	75
" 1st Mtg. 5's	250,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	26
Bonds, 1st 5's	3,322,000	1,000	101¼	103
Laclede, St. Louis	7,500,000	100	68¾	69
Preferred	2,500,000	100	35	100
Bonds	10,000,000	1,000	107	107½
Lafayette Gas Co., Ind.	1,000,000	100	35	40
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	110	120
Madison Gas & Elec. Co.	400,000	100	68	75
" 1st Mtg. 6's	350,000	1,000	102½	108
Montreal, Canada	2,000,000	100	183	184½
Newark, N. J., Con. Gas Co Bonds, 6's	6,000,000	..	..	55
	4,600,000	..	..	103
New Haven	1,000,000	25	280	300
Nashville Gas Lt. Co.	1,000,000	50	110	..
Oakland, Cal.	2,000,000	..	46	47
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	98⅝	99¼
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	90¾	91
2d "	2,500,000	1,000	104	105
Rochester Gas & Elec. Co.. Preferred	2,150,000	50	86	..
	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	47¼	47½
St. Paul Gas Light Co.	1,500,000	100	46	49
1st Mortgage 6's	650,000	1,000	82	85
Extension, 6's	600,000	1,000	..	..
General Mortgage, 5's..	2,498,000	1,000	88	90¼
St. Joseph Gas Co.	1,000,000	100	30	35
" 1st Mtg. 5's	750,000	1,000	96½	98
Syracuse, N. Y.	1,750,000	100	9	10
Bonds	1,612 000	1,000	86¾	93
Washington, D. C	2,800,000	20	270	271
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	100	90	91
Bonds, 5's	3,880,500	..	107	107½
Wilmington, Del.	600,000	50	200	201

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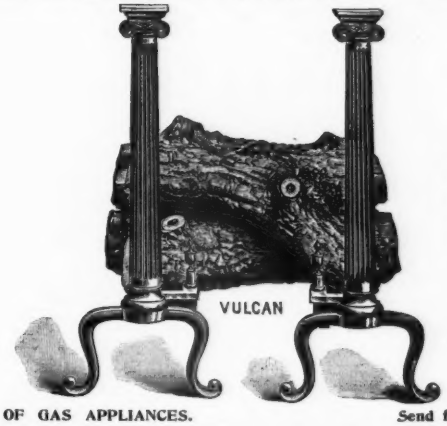

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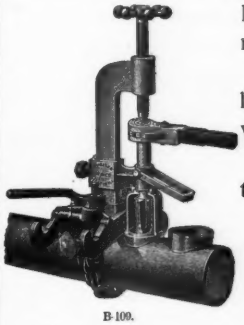

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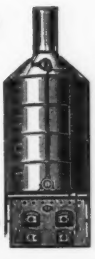

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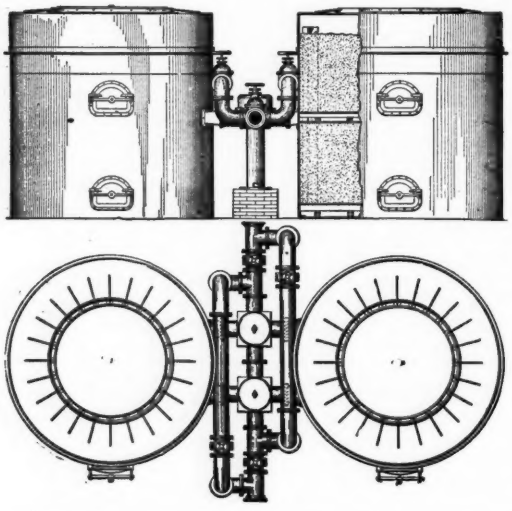

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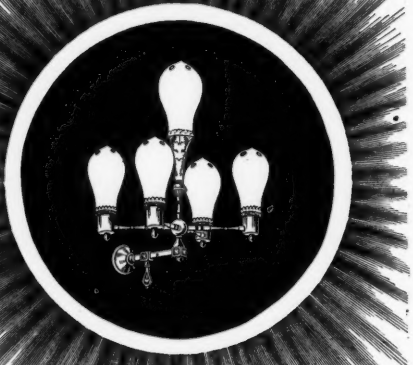

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SAVES 80 PER CENT. OF YOUR GAS BILL.

THE NEW DISCOVERY.

BURNS ONE CUBIC FOOT OF GAS PER HOUR.

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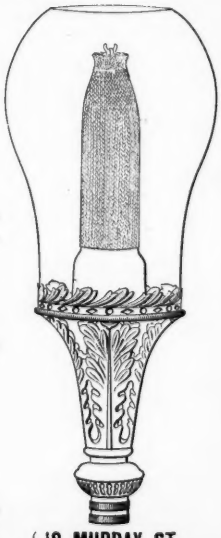
35 TO 40 CANDLES PER CUBIC FOOT.

Burner No.	0	consumes	8-10	cubic foot,	30-candle power.
"	1	"	1	"	35 "
"	2	"	2	cubic feet,	70 "
"	3	"	3	"	105 "
"	4	"	4	"	140 "
"	7	"	7	"	225 "



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For continuous records of **Street Gas Pressure.** Simple in construction, accurate in operation, and low in price.

Fully Guaranteed. Send for Circulars.

THE BRISTOL CO.,
Waterbury, Conn.

Silver Medal, Paris Exposition.

Steward Burners.

Closest Attention to **Durability, Candle Power, Finished Appearance.**

Samples to be Had for the Asking.

Write for neat vest pocket memorandum book. Sent Free.

The D. M. Steward Mfg. Co.,

New York Office, 107 CHAMBERS ST.
CHATTANOOGA, Tenn.

SAFETY GAS MAIN STOPPER CO.

108 EAST 117TH ST., N. Y.

FOR SHUTTING OFF GAS IN MAINS TEMPORARILY DURING ALTERATIONS AND REPAIRS

CHAPMAN VALVE MANUFACTURING CO.

MANUFACTURERS OF

Valves and Gates for Gas, Ammonia, Water, Etc.

Also, Gate Fire Hydrants with and without Independent Nozzle Valve. All Work Guaranteed.

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Chicago Office, 24 West Lake St. New York Office, 28 Platt St.
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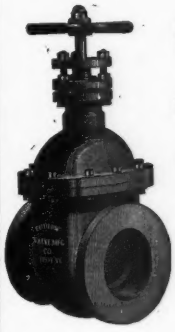

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TROY, N. Y., U. S. A.

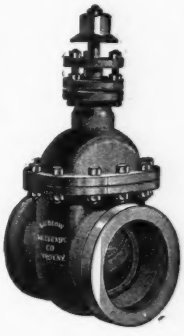
Double and Single Gate Valves, ¼" to 72",

—FOR—

Gas, Water, Steam, Oil, Ammonia, Etc.

HOT GAS VALVES A SPECIALTY.

Send for Catalogue.



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WILLIAM M. CRANE COMPANY,
SOLE AGENTS FOR UNITED STATES,
1131-1133 Broadway, New York.

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Distributing Agents for Pacific Coast,
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THE LINK-BELT MACHINERY CO.,

ENGINEERS, FOUNDERS, MACHINISTS,
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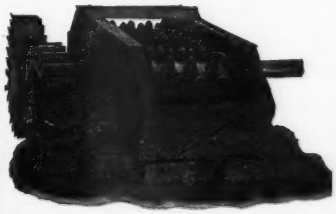

"Link-Belt" Breaker.

LINK-BELT ELEVATING & CONVEYING MACHINERY for HANDLING COAL, COKE, OXIDE, ETC.

Tilting Coal and Coke Cars, Breaker Rolls, Shaking Screens, Power Transmitting Machinery.

Machinery designed and erected to suit existing conditions and available space.

CATALOGUE UPON APPLICATION

AMERICAN GAS COMPANY

Constructors of Coal Gas Apparatus.

EASTERN AGENTS FOR

BREDEL'S SYSTEM
COAL GAS PLANTS AND GAS APPARATUS.

P. H. & F. M. ROOTS CO.'S
Exhausters, Governors, etc.

GENERAL AGENTS FOR

BRONDER'S CHARGING AND DISCHARGING MACHINES.

AMERICAN GAS COMPANY,

222 South Third Street, Philadelphia, Pa.

FRED. BREDEL, C.E.

Coal and Water Gas Plants.

OWN SYSTEM.

RECUPERATIVE FURNACES, WASHERS, CONDENSERS, PURIFIERS, PURIFYING MACHINES, COKE CONVEYERS, ETC.

SOLE UNITED STATES AGENT FOR
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Gas Enriching Plants to Enrich Coal Gas up to 24 Candle Power, and Making a White, Bright, Non-smoking Gas.

GAS RETORTS AND SPECIAL BLOCKS AND FIREBRICK MANUFACTURED UNDER THE SUPERINTENDENCE OF MY OWN CHEMIST.

COMPLETE GAS WORKS

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LATEST IMPROVED GAS EXHAUSTER

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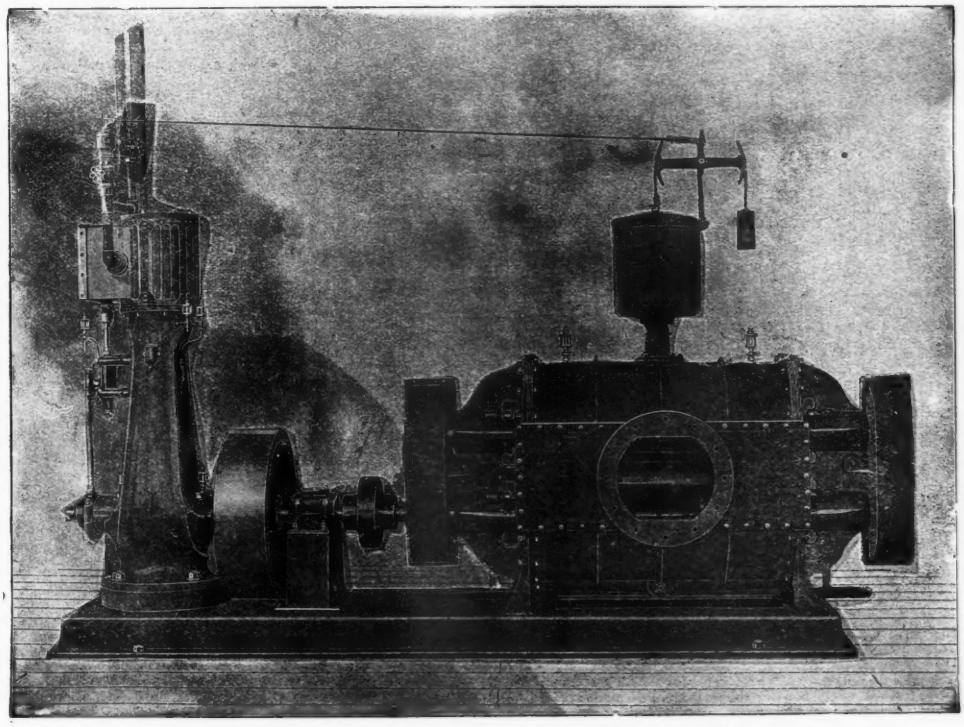
NEW GAS GOVERNOR AND STEAM VALVE.

GUARANTEED TO REGULATE WITHIN ONE-TENTH OF AN INCH, WATER PRESSURE.

The Most Perfect Gas Governor on the Market.

MORE DIRECT IN ACTION. FEWER PARTS.
EASIER TO ADJUST THAN ANY OTHER GOVERNOR.



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Established 1856. Works at Phillipsburgh, N. J.

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CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

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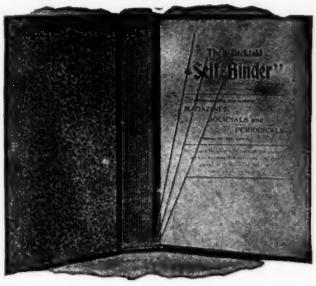

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THE NOVELTY STEAM BOILER WORKS,

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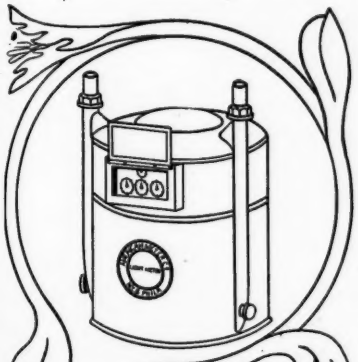
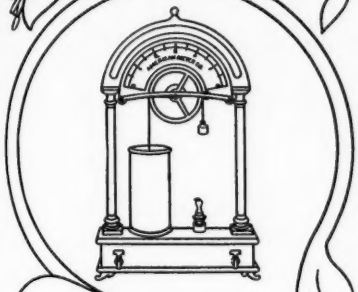
STORAGE TANKS FOR GAS WORKS,

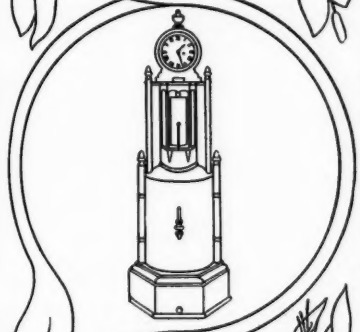
To Retain Fluid Material of Any Sort.

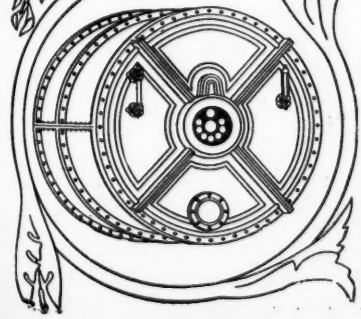
PIPING IN AND AROUND GAS WORKS.

Work Done for Several of the Largest Gas Companies in America Stands as Reference.









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NEW YORK AND PHILADELPHIA,

CHICAGO, ST. LOUIS,

SAN FRANCISCO.

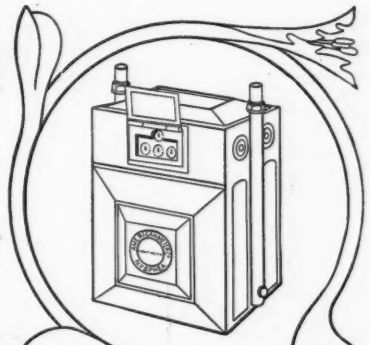
PUBLIC LIGHTING TABLE.

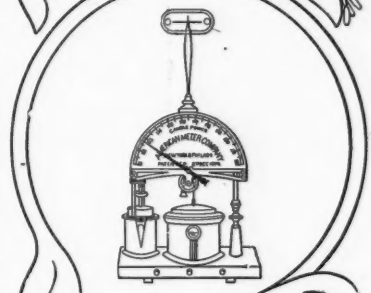
NOVEMBER, 1900.

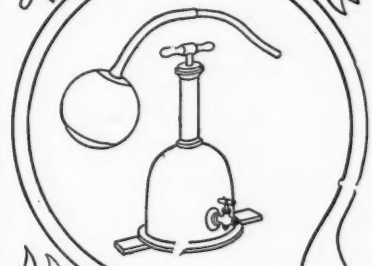
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Thu.	1	12.10 AM	5.30 AM	4.45	5.35
Fri.	2	1.30	5.30	4.45	5.35
Sat.	3	2.40	5.30	4.45	5.35
Sun.	4	3.50	5.30	4.45	5.35
Mon.	5	No L.	No L.	4.40	5.45
Tue.	6	No L. FM	No L.	4.40	5.45
Wed.	7	No L.	No L.	4.40	5.45
Thu.	8	5.20 PM	7.20 PM	4.40	5.45
Fri.	9	5.20	8.20	4.40	5.45
Sat.	10	5.20	9.20	4.40	5.45
Sun.	11	5.10	10.30	4.40	5.45
Mon.	12	5.10	11.30	4.30	6.00
Tue.	13	5.10 LQ	12.30 AM	4.30	6.00
Wed.	14	5.10	1.30	4.30	6.00
Thu.	15	5.10	2.20	4.30	6.00
Fri.	16	5.10	3.20	4.30	6.00
Sat.	17	5.10	4.20	4.30	6.00
Sun.	18	5.10	5.50	4.30	6.00
Mon.	19	5.10	5.50	4.25	6.00
Tue.	20	5.10	5.50	4.25	6.00
Wed.	21	5.10 NM	5.50	4.25	6.00
Thu.	22	5.10	5.50	4.25	6.00
Fri.	23	5.10	5.50	4.25	6.00
Sat.	24	5.10	5.50	4.25	6.00
Sun.	25	5.10	6.00	4.25	6.00
Mon.	26	7.50	6.00	4.20	6.10
Tue.	27	9.00	6.00	4.20	6.10
Wed.	28	10.00	6.00	4.20	6.10
Thu.	29	11.10 FQ	6.00	4.20	6.10
Fri.	30	12.20 AM	6.00	4.20	6.10

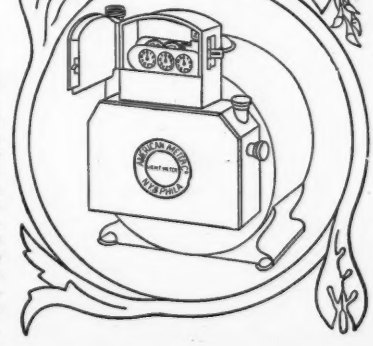
TOTAL HOURS LIGHTING DURING 1900.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	230.50	January	423.20
February	175.40	February	355.25
March	189.00	March	355.35
April	160.30	April	298.50
May	150.40	May	264.50
June	137.00	June	234.25
July	152 00	July	243.45
August	171.50	August	280.25
September	187.20	September	321.15
October	213.10	October	374.30
November	221.50	November	401.40
December	231.50	December	433.45
Total, yr.	2221.40	Total, yr.	3987.45









NEW YORK, 33 Nassau St. PHILADELPHIA, Broad and Arch Sts. CHICAGO, 54 Lake St.

Welsbach Street Lighting Company

.... OF AMERICA ....

No. 36.

Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in seventy-five Cities and Towns.

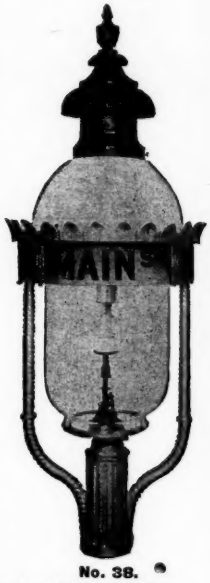
By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.



No. 38.

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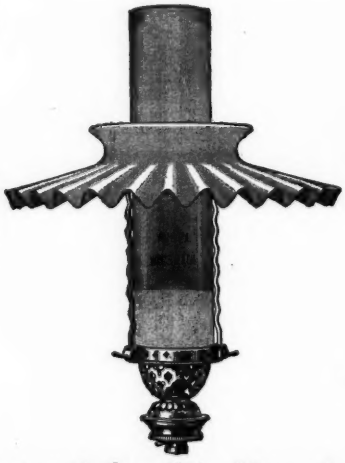
Welsbach Famous Mantles.

THE INCOMPARABLE

"USEA" Welsbach MANTLE

FINEST EXAMPLE OF INCANDESCENT GAS LIGHT EVER EXHIBITED.



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THE HIGHEST ILLUMINATION, The Lowest Cost.

Welsbach Lamps, Mantles, and Complete Line of Glassware and Supplies

WELSBACH COMPANY,

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Chicago Branch Department and Supply House, - - - - - 70 Wabash Avenue.

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THE STANDARD DOUBLE SUPERHEATER LOWE WATER GAS APPARATUS.

CONTRACTS RECEIVED SINCE JANUARY 1, 1900.

	SETS.		SETS.
DANSVILLE, N. Y.	1	HACKENSACK, N. J.	1
WEST CHESTER, PA.	1	TIFFIN, O.	1
COHOES, N. Y.	2	MOUNT HOLLY, N. J.	1
OGDEN GAS CO., CHICAGO	1	SEATTLE, WASH.	1
CENTRAL UNION GAS CO., NEW YORK	1	TARRYTOWN, N. Y.	1
SPENCER, MASS.	1	HOBOKEN, N. J.	2
SAN FRANCISCO	1	PATERSON, N. J.	2
BROOKLYN UNION GAS CO., BROOKLYN	1	NEWARK, N. J.	2
RICHMOND, VA.	2	JERSEY CITY, N. J.	1
CAMBRIDGE, MASS.	2	AUSTIN, TEX.	1
CARBONDALE, PA.	1		

NUMBER OF SETS 27
TOTAL SETS INSTALLED TO JANUARY 1, 1900 327

TOTAL SETS INSTALLED TO DATE 354
TOTAL DAILY CAPACITY . . . . . 226,600,000 Cubic Feet.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY Prest. DAVID R. DALY V. Prest. & Treas. H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

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Jersey City, N. J.

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CLAY GAS RETORTS, FIRE CLAY TILES, FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

E. D. WHITE, President. A. H. GUTKES, Vice-President. H. A. PERKINS, Secretary.

Brooklyn Fire Brick Works,

MANUFACTURERS OF

CLAY RETORTS, FIRE BRICK, Gas House and other Tile.

Office, 88 Van Dyke St. Brooklyn, N. Y

Established 1854. Incorporated 1869.

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Manufacturers of { GAS RETORTS . . FIRE BRICK . . . RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

Proprietors for the U. S., Coze System of Inclined Benches.

Estimates Furnished on Application for Most Successful Style of Construction.

Also for Free-Firing and Full and Half-Depth Regenerative Benches, for Burning either Coal or Coke in the Furnaces.

Office: 914, 915 & 916 Wainwright Building, St. Louis, Mo.

The Construction of Gas Works

PRACTICALLY DESCRIBED,

By WALTER RALPH HERRING.

Price $2. For Sale by

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32 Pine Street, N. Y. City.

Adam Weber,

Proprietor,

Manhattan Fire Brick and Enameled Clay Retort Works.

Works, Weber, N. J.

Office, 633 East 15th St., New York.

Modern Recuperative Furnaces

And Standard Fire Brick and Gas Retorts.

Works, LOCKPORT STATION, PA.

—ESTABLISHED 1864.—

JAMES GARDNER, JR., CO.,

Hamilton Building, Fifth Avenue, PITTSBURGH, PA. P. O. Box 373.

Successor to WILLIAM GARDNER & SON,

Fire Clay Goods for Gas Works.

SOLE REPRESENTATIVE OF THE McILHENNY REGENERATIVE BENCHES FOR THE U. S.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.

OFFICE, 418 to 422 East 23d St., N. Y.

Clay Gas Retorts,

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

Price List, f.o.b. Galesburg, Ills., or Buffalo, N. Y.

In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD, Galesburg, Ills.

For orders East of Buffalo, N. Y., or Pittsburg, Pa., freight will be paid to these points.

Parker-Russell Mining and Mfg. Co.,

CITY OFFICE,
417 Pine Street, St. Louis, Mo.

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OAKHILL GAS RETORT & FIRE BRICK W'KS

Our immense establishment is now employed almost entirely in the manufacture of

Materials for Gas Companies

We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. We construct

Half and Full Depth Benches of Our Own Design,

Containing 6, 8 or 9 Retorts.

We have Greatly Improved our Recuperators. Coal or Coke can be used as Fuel in Furnaces.

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MANUFACTORY AT

LOCUST POINT, BALTIMORE, MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY, AND FIRE CEMENT.

Our Improved Half and Full Depth Benches have been Adopted by Many Gas Companies.

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Sole Agents for New England States.

JOHN DELL, General Manager.

MISSOURI FIRE BRICK CO.,

ESTABLISHED 1882.

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We are prepared to furnish and erect COMPLETE, Half and Full Depth Benches of 6's, 8's, 9's, with Regenerative Furnaces, Constructed to Burn either Coal or Coke. Also Plain Benches.

CORRESPONDENCE IS RESPECTFULLY SOLICITED.

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National Gas and Water Company.

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Gas Plant Machinery

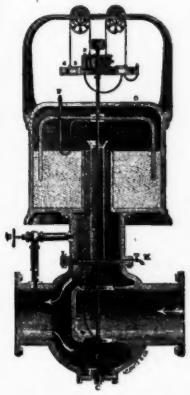
SOFT COAL OR COKE
WATER GAS GENERATORS
A SPECIALTY.

218 LA SALLE ST.,
CHICAGO.

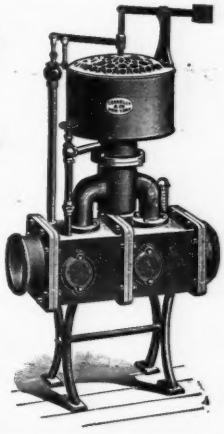
Gas Engineers
INSPECTION AND ADVICE.

PLANS AND ESTIMATES
FOR IMPROVEMENTS OR
REPAIRS.

GAS WORKS SPECIALTIES,



AUTOMATIC STREET GAS GOVERNORS,
BALANCE GAS GOVERNORS.
"Iron Sponge" and Natural Oxide
FOR GAS PURIFICATION.
EXHAUSTERS, ETC.



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No. 357 CANAL STREET,
NEW YORK CITY.

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Hughes'
"Gas Works,"
Their Construction and Arrangement,
And the Manufacture and Distribution of Coal Gas.

Originally written by SAM'L HUGHES, C.E.
Rewritten and Much Enlarged by
WM. RICHARDS, C.E.
Eighth Edition, Revised, with Notices of Recent Improvements.
Price, $1.65.
A. M. CALLENDER & CO.,
32 Pine St., N. Y City.

Parson's Steam Blower
FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.
PARSON'S TAR BURNER,
FOR USING COAL TAR AS FUEL.
PARSON'S AIR JET TUBE CLEANER,
FOR CLEANING BOILER TUBES.
These devices are all first-class. They will be sent to any responsible party *for trial*. No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY.
H. E. PARSON, Supt., 457 Putnam Ave., Brooklyn, N. Y.

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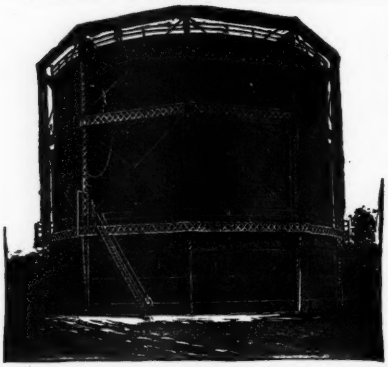

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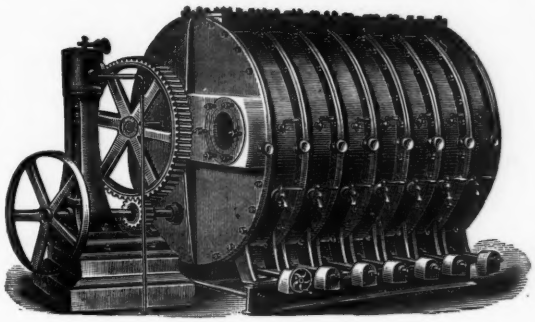

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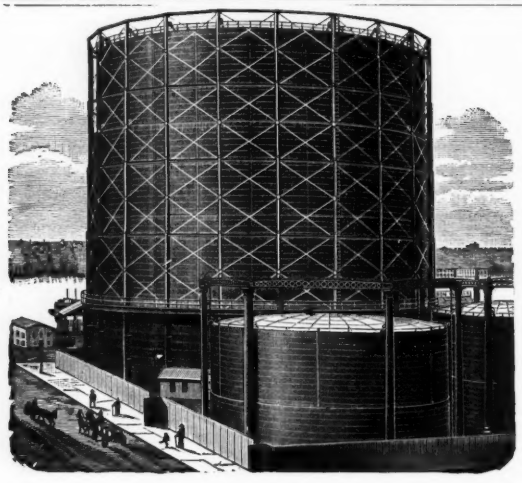

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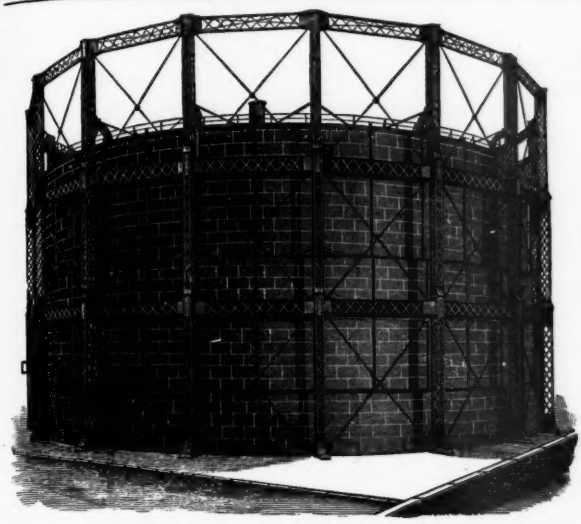

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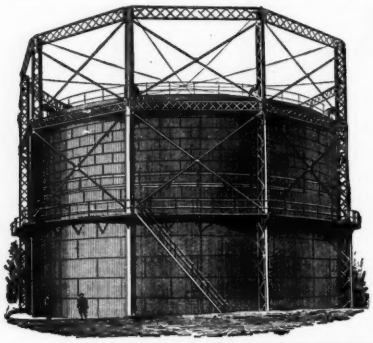

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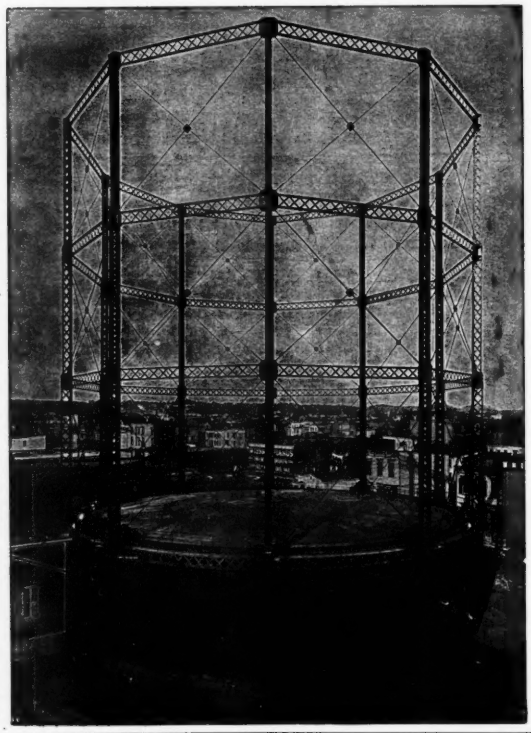

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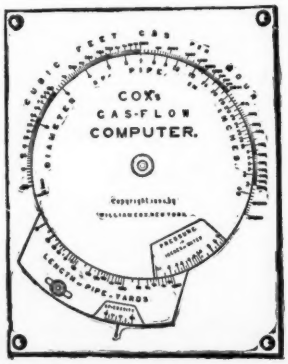

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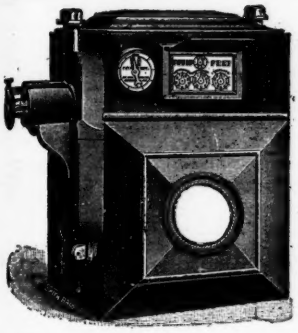

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FOR THE COMPLETE, PROGRESSIVE TREATMENT OF THE GAS FROM THE HYDRAULIC MAIN TO THE STATION METER,

Comprising gradual condensation, extraction of tar without loss of illuminants, extraction of ammonia with large percentage of CO_2 and sulphur by thorough washing and completing the extraction of sulphur by purification, either in ordinary purifiers, or our **IMPROVED BEAL DUPLEX PURIFIERS or DOHERTY-BUTTERWORTH PATENT PURIFIERS,** giving double the capacity of ordinary purifiers on the same floor area.

This system is thoroughly protected by patents issued or applied for, and does not infringe any other Process or Patents, and in almost all instances **makes use of existing apparatus.**

We have also supplied our Tar Extracting and Washing Apparatus to a number of works for use in connection with existing equipment.

WILLIAM HENRY WHITE,
EASTERN ENGINEER,
32 Pine St., New York.

The Western Gas Construction Co.,
FORT WAYNE, IND.